U.S. DEPARTMENT OF THE INTERIOR

OFFICE OF WATER RESEARCH AND TECHNOLOGY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 18
SEPTEMBER 15, 1980

W80-05701 – W80-06000
CODEN: SWRABW

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A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

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W80-05701 -- W80-06000

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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For primary bibliographic entry see Field 5F.
W80-05965

1B. Aqueous Solutions and Suspensions

HALIDE ION ENHANCEMENT OF CHROMIUM (IID, IRON (II), AND COBALT (II) CATALYSIS OF LUMINOL, CHEMILUMINESCENCE,
Maine Univ. at Orono. Dept. of Chemistry.
C. A. Chang, and H. H. Patterson.
Analytical Chemistry, Vol 52, No 4, p 653-656, April 1980. 5 Fig, 1 Tab, 17 Ref.OWRT B-016-ME(2).

Descriptors: *Chemical analysis, *Spectroscopy, *Chemiluminescence, *Halides, Inorganic compounds, Chloride, Bromine, Chlonne, Fluorine, Halogens, Ions, Chemical reactions, *Iron, *Cobalt, *Chromium.

The analytical applications of the 'halide effect' or enhancement of chemiluminescence of trace metal ion catalyzed luminol oxidation by hydrogen peroxide were examined for three ions, chromium (III), iron (II), and cobalt (II). Possible mechanisms for this effect were also investigated. Experiments were performed using a flow system with two 20-ml plastic syringes. The metal ion sample to be tested, with or without halide ions was in one syringe, while a luminol and hydrogen peroxide solution at the desired pH was in the other syringe. A Sage Model 351 syringe pump was used to drive the system. Prior to entering a quartz flow cell in a Perkin-Elmer MPF-44A Fluorescence Spectrometer, the metal ion solution was mixed with the luminol-H202 solution. EDTA was added to the complex for Cr (III) analysis but for Co (II) and Fe (II) analysis. Only bromide and chloride ions were extensively tested. Results show that enhancement remains nearly constant at different metal ion concentrations. Enhancement does vary with the pH of the luminol-H202 solution. At the optomized pH of analysis, additions of 0.3 M Br(-) produced enhancements of 6.2-fold for Cr III, 3.5-fold for Fe (II), and 1.4-fold for Co (II). Enhancement was not observed when the pH was greater than 12.5 and the chemiluminescence intensity was almost zero. A mechanism of the halide effect of a typical metal ion catalyzed chemiluminescence reaction is discussed along with possible analytical applications of the halide effect. (Seigler-IPA)
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For primary bibliographic entry see Field 2B.
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Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2E.
W80-05929

GUIDELINES FOR CALIBRATION AND APPLICATION OF STORM,
Hydrologic Engineering Center, Davis, CA.
J. Abbott.
Training Document No 8, December 1977. 49 p, 10 Fig, 2 Tab, 16 Ref.

Descriptors: *Urban runoff, *Water pollution, *Model studies, *Watersheds(Basins), Water pollution sources, Water quality, Discharge(Water), Urban drainage, Precipitation(Atmospheric), Runoff, Land use, Calibrations, Storm runoff, Evaporation, Soil erosion, Hydrologic data, Biochemical oxygen demand, Sampling, STORM, Data requirements, Pollutograph.

This report provided specific information on calibration and application of the Storage, Treatment, Overflow Runoff Model (STORM). The STORM model is intended for use in simulaton of the quantity and quality of storm water runoff. In particular, the report discussed procedures for collection of rainfall, runoff quantity and quality data. Procedures were recommended for management of the collected data. Recommendations were provided for use of the site-specific data in calibration of the model. The calibrated model can then be used for two important planning components of a storm water study. These are: (1) Prediction of wet-weather pollutographs (mass loading curves) for use in a receiving water assessment model. These pollutographs can include both surface runoff and dry weather flow in combined system. Since the computations are based on land use, the impact of land use change can be evaluated. (2) Preliminary sizing of storage and treatment facilities to satisfy desired criteria for control of storm water runoff. The model will analyze a matrix of combinations of storage and treatment rates. Results include frequency information on quantity and quality of washoff of pollutants and soil erosion, as well as frequency information on the quantity and quality of storage overflows. (Humphreys-ISWS)
W80-05930

DETERMINATION OF LAND USE FROM LANDSAT IMAGERY: APPLICATIONS TO HYDROLOGIC MODELING,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 7B.
W80-05931

CONTINUOUS HYDROLOGIC SIMULATION OF THE WEST BRANCH DUPAGE RIVER ABOVE WEST CHICAGO: AN APPLICATION OF HYDROCOMP'S HSP,
Hydrologic Engineering Center, Davis, CA.
R. J. Cermak.
Research Note No 6, July 1979. 68 p, 19 Fig, 13 Tab, 3 Ref, 1 Append.

Descriptors: *Urban hydrology, *Illlnois, *Model studies, *Watersheds(Basins), River basins, Mathematical models, Precipitation(Atmospheric), Evaporation, Infiltration, Land use, Calibrations, Discharge frequency, Discharge(Water), Urban runoff, Simulation and analysis, *DuPage River Basin(IL), Data requirements.

The purpose of this report was to document the calibration and application of an HSP model for the DuPage River basin, and to evaluate HSP as a tool in urban hydrologic analysis. Topics were discussed in the following order: model structure, parameters, and data requirements; a description of the study basin, parameter calibration, and land use; calibration results, long record simulation, estimation of discharge frequency, and conclusions. An HSP continuous hydrologic simulation model of the West Branch DuPage River above West Chicago was calibrated and verified, long-record precipitation and other meteorologic data were assembled and provided as input to the model, and resulting annual peak discharges used to estimate discharge frequency at the gage site for constant present conditions. Continuous hydrologic simulation provides a viable alternative as a method of analysis for urban hydrologic systems. It requires large amounts of data and significant labor to calibrate an HSP model to a specific basin. For studies that warrant such a detailed definition of the hydrologic process, the model provides a rational representation of basin hydrology that could be applied to the investigation of complex water resource problems. (Humphreys-ISWS)
W80-05932

SOURCES OF COMPUTER PROGRAMS IN HYDRAULICS,
American Society of Civil Engineers, New York. Hydraulics Div.
Journal of the Hydraulics Division, American Society of Civil Engineerings, Vol 106, No HY5, Proceedings Paper 15435, p 915-922, May 1980.

Descriptors: *Bibliographies, *Hydraulics, *Mathematical models, *Computer models, *Computer programs, Numerical analysis, Water resources, Unsteady flow, Diffusion, Mixing, Groundwater, Surface waters, Oceans, Estuaries, Coastal engineering, Hydrology.

As one of its duties, the Task Committee on Computational Hydraulics, Hydraulics Division, ASCE, has compiled a list of bibliographies and publications that list the availability of various mathematical, numerical and computer models for general use by hydraulic engineers. The compilation covered several major areas such as hydraulics, hydrology, groundwater, surface water, water-resources management, unsteady flow, estuaries, and so forth. Most of the entries were described by essential information such as author(s), editor(s), or personnel to contact, year of publication or compilation, title, publishing journal or issuing organization, number of pages, number of references, programs or models listed, author affiliation, project sponsor, and notes that summarize any other pertinent and helpful information. It was hoped that the material included in the list will aid potential model users in finding suitable bibliographies, contracting key personnel, and accessing appropriate computing facilities. (Sims-ISWS)
W80-05948

CHARACTERISTICS OF LOW FLOWS,
American Society of Civil Engineers, New York. Hydraulics Div.
For primary bibliographic entry see Field 2E.
W80-05954

2B. Precipitation

PROJECT SKYWATER DATA INVENTORY, 1979 HIPLEX SEASON, HIGH PLAINS COOPERATIVE PROGRAM,

Water and Power Resources Service, Denver, CO. Available from the National Technical Information Service, Springfield, VA 22161 as PB80-189988, Price codes: A10 in paper copy, A01 in microfiche. Office of Atmospheric Resources Management, December 1979. 162 p, 39 Fig, 52 Tab, 1 Append.

Descriptors: *Weather modification, *Artificial precipitation, *Cloud seeding, *Data collections, Meteorological data, Meteorology, Weather data, Precipitation(Atmospheric), Radar, Remote sensing, Weather patterns, Cloud physics, Aircraft, Aerial photography.

All data collected from May through July 1979 as part of the HIPLEX (High Plains Cooperative Program) is reported. HIPLEX is a weather modification research project involving spring and summer convective cloud seeding. The two major areas involved in the project are Miles City, Montana, and Big Spring-Snyder, Texas. Data are reported in the following categories: (1) radar, (2) satellite, (3) aircraft, (4) rawinsondes, (5) precipitation gages, (6) surface meteorology, (7) photography, (8) NWS, FAA, and National Climatic Center Products, and (9) miscellaneous observations, notes, and reports. Radar data were collected from five radar sites, two SWR-75 5-cm radars, the University of North Dakota WR100-5 radar, the Colorado River Municipal Water District FPS-77 radar, and the National Weather Service WSR-57 radar. Satellite data cover the entire HIPLEX area and some important upwind and downwind areas. These data are in the form of laserfax photographs and digital data on magnetic tape. Six aircraft were used to gather information: the University of Wyoming Super Air King, a CIC Learjet, the AES and NAE Twin Otter, the MRI Piper Navajo, the CRMWD Navajo, and the CRMWD Aztec. Rawinsonde data were collected from nine sites in the area. Precipitation data are available on tape or microfiche, the basic data are 15-minute totals each precipitation gage. A network of 25 automatic surface stations was used to collect meteorological data. (Seigler-IPA)
W80-05762

SUMMER FLOODING AT CHICAGO AND POSSIBLE RELATIONSHIPS TO URBAN-INCREASED HEAVY RAINFALL,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr.
Water Resources Bulletin, Vol 16, No 2, p 323-325, April 1980. 2 Tab, 5 Ref. NSF ENV77-15375.

Descriptors: *Flooding, *Flood recurrence interval, *Storm water, Floods, Storms, Rainfall, Urban runoff, Urban hydrology, Urban drainage, Rainfall intensity, *Summer flooding, *Chicago, Summer rainfall, Heavy rainfall, Urban rainfall, Urban factors, Flood events.

Studies of two measures of flooding in the Chicago metropolitan area revealed a wide range of floods with the magnitude related to recurrence interval expressions of rain intensity. Minor type floods in basements and underpasses usually result from localized heavy rains with return intervals of 1 to 2 years, and more major floods result from rains with return intervals of 2 to 5 years or more. Urban factors help lead to increases in warm season rain events in Chicago with 1- to 4-year return intervals. These apparently help lead to 10-100% more flooding events in Chicago than expected. The range of increase varies depending on locale and type of flood, but the increases in storms should be accounted for in drainage designs. (Roberts-ISWS)
W80-05766

HAILSTORMS IN SOUTHERN SASKATCHEWAN,
Regina Univ. (Saskatchewan). Dept. of Geography.
A. H. Paul.
Journal of Applied Meteorology, Vol 19, No 3, p 305-314, March 1980. 5 Fig, 4 Tab, 27 Ref.

Descriptors: *Hail, *Climatology, *Canada, *Great Plains, Frequency, Storms, Particle size, Precipitation(Atmospheric), Damages, Climatic data, Surveys, Meteorology, Weather, Meteorological data, *Saskatchewan.

This article represented a first attempt at a climatological investigation of the hail problem in the Canadian province of Saskatchewan. Initial results from a 5-year study in southern Saskatchewan, carried out through a volunteer observing network, indicated that the hailstorms of this section of the Great Plains are comparable in hailfall characteristics to those of the High Plains. Stone size distributions, hailfall intensity values, and durations of hail are really no different. These indices of severity bear out loss costs (loss-to-risk ratio) for crop-hail insurance that are only slightly lower than those for Alberta, and lend credence to the estimate that hail losses in Saskatchewan are approximately equal to one-seventh of those in the entire United States. (Sims-ISWS)
W80-05769

INTERCEPTION OF VERTICAL AND HORIZONTAL PRECIPITATION IN THE FORESTS OF THE CENTRAL URAL,
Akademiya Nauk SSSR, Sverdlovsk. Inst. of Plant and Animal Ecology.
N. N. Shevelev.
Soviet Hydrology: Selected Papers, Vol 16, No 4, p 313-318, 1977. 3 Tab, 18 Ref. Translated from Forestry (Lesovedeniye), No 6, p 38-46, 1977.

Descriptors: *Precipitation(Atmospheric), *Interception, *Forests, *Hydrologic budget, Fog, Rime, Dew, Rain, Snow, On-site investigations, Data collections, Evaporation, Foreign research, Coniferous forests, Forest watersheds, Fir trees, *USSR, *Central Ural(USSR).

The influence of the dark coniferous forests of the Central Ural on some components of the hydrologic budget, including the interception of vertical precipitation (rain and snow) and horizontal precipitation (fog, rime, and dew), was investigated. It was concluded that: (1) Study of the supply of precipitation to forests on the western macroslope of the low-mountain province of the Central Ural (southern taiga subzone) showed that summer interception amounts to 49-85 mm (11-35%) for native fir-spruce forests, and the relative amount intercepted decreases in normally wet years. Winter interception amounts to 0-49 mm (0.25%) in original forests and 0-50 mm (0-26%) in secondary forests, depending on their composition, age, and density. (2) In dry years, original fir-spruce forests capture an insignificant amount of horizontal precipitation (20 mm in summer and about 20 mm in winter at elevations of 500-600 m). In normally wet years, the total amount of horizontal precipitation captured by forests at elevations from 500 to 700 m is 50-80 mm. Data on total interception and quantitative and visual observations indicate that the amount of horizontal precipitation in the forests increases with absolute elevation. This precipitation begins to play a role in the water supply of forests above 450 m, i.e., the lower boundary of the zone of this precipitation corresponds to the lower limit of the nemoral and subnemoral ecological-geographic mountain-taiga forest complexes in the southern taige subzone of the Ural. (3) The annual interception of rain and snow by fir-spruce forests decreases with increasing absolute elevation and varies from 49 to 126 mm (400-700 m). (4) Data on interception and on horizontal precipitation, as well as the literature on total evaporation suggest that the water-conserving role of the dark coniferous forests of the Central Ural increases with absolute elevation. (Humphreys-ISWS)
W80-05773

IS YOUR WEATHER BEING MODIFIED,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 4C.
W80-05778

RAINFALL/WATERSHED RELATIONSHIPS FOR SOUTHWESTERN THUNDERSTORMS,
Science and Education Administration, Tucson, AZ. Southwest Watershed Research Center.
H. B. Osborn, L. J. Lane, and V. A. Myers.
Transactions of the American Society of Agricultural Engineers, Vol 23, No 1, p 82-87 and 91, January-February 1980. 18 Fig, 2 Tab, 10 Ref.

Descriptors: *Rainfall, *Thunderstorms, *Southwest U.S., Frequency, Spatial distribution, Depth-area curves, Depth-area-duration analysis, Rain, Rain gages, Networks, Watersheds(Basins), Runoff, Climatic data, Climatology, Rainfall-runoff relationships.

Depth-area relationships for thunderstorm rainfall were developed from 20 years of records from dense raingage networks in Arizona and New Mexico, using the National Weather Service method described in NOAA Atlas 2. The relationships were compared with similar previously published ones. Relationships also were developed to indicated the distribution of storm rainall over a watershed. This information could be valuable to agencies, groups, and individuals involved in water resources design and evaluation for climatologically similar areas. (Sims-ISWS)
W80-05836

THE EFFECTS OF RECENT CHANGES IN ATMOSPHERIC CIRCULATION ON THE HYDROLOGY OF THE KANKAKEE RIVER,
Indiana Univ. at Bloomington. Dept. of Geography.
J. M. Davis, and J. J. Hidore.
Water Resources Bulletin, Vol 16, No 2, p 336-339, April 1980. 7 Fig.

Descriptors: *Weather, *Runoff, *Watersheds(Basins), *Rivers, *Central U.S., *Indiana, Climatology, Precipitation(Atmospheric), Circulation, Air circulation, Temperature, Air temperature, Snow, Snowfall, Winter Hydrology, Meteorology, *Kankakee River(IN).

In North America the four successive winters from 1974-1975 through 1977-1978 were very different from each other in terms of atmospheric circulation and resulting surface weather conditions. The first year of the seuqence there was a near normal circulation pattern. The following years were characterized by the gradual amplification of an upper atmosphere ridge over the West Coast coupled with an eastward displacement of a long-wave trough east of the Rocky Mountains. These changes in circulation brought below normal temperatures to the Midwest, below normal precipitation and increasing snowfall which reached record levels in February 1978. These atmospheric changes brought about changes in the flow of the Kankakee River. Total runoff in the winter half-year dropped as precipitation and temperatures dropped; there was a marked retarding of winter runoff and the yield of the watershed increased. (Sims-ISWS)
W80-05855

RAINFALL VARIABILITY AND ANIMAL PRODUCTION IN THE SEMI-ARID SAVANNA OF SOUTHERN AFRICA,
Henderson Research Station, Salisbury (Rhodesia).
D. L. Barnes, and L. McNeill.
Proceedings of the Grassland Society of Southern Africa (Pietermaritzburg), Vol 13, p 59-63, 1978. 4 Fig, 25 Ref.

Descriptors: *Grasslands, *Semiarid climates, *Rainfall, *Precipitation intensity, *Animal populations, Environmental effects, Water balance, Livestock, Browse utilization, Stocking, Stress, Droughts, Vegetation, Evapotranspiration, Evaporation, Animal growth, On-Site tests, Model studies, Evaluation, Insect control, Mathematical models, Moisture stress, Africa, Southern Africa.

The erratic moisture supply of the semi-arid savanna of Southern Africa has a great impact on the plant production of the area. The increasing numbers of domestic livestock in the savanna have put a great stress on the herbaceous layer and without proper management, permanent damage to the environment may occur. This report emphasizes the need for a comprehensive study of the effects of rainfall fluctuations on plant and livestock production, botanical composition, and soil cover. Stock-

ing probably should be limited by the amount of food available in seasons of low plant production (critical seasons) to avoid undue stress on the livestock and vegetation. Control of harvester termites is desirable in order to maintain an adequate plant cover. Plant production can be easily estimated by the amount of rainfall and simple water balance models. Production of herbaceous vegetation in the semi-arid savanna can be estimated using evapotranspiration and evaporation pan data, but the estimates for browse plants are more difficult. A field scale test of animal production as a function of herbage is needed to establish the conditions necessary for the maximum weight gain per animal. A simulation model for relating plant and animal production therefore relies on a simple water balance model, gain per animal, herbage intake per animal, and stocking pressure. (Sidney-IPA)
W80-05902

ACID PRECIPITATION AND SULFATE DEPOSITION IN FLORIDA,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 2K.
W80-05934

COMPOSITION FOR AND METHOD OF CAUSING RAINFALL,
M. M. Osorio.
U.S. Patent No 4,176,790, 3 p, 3 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 135, December 4, 1979.

Descriptors: *Patents, *Rainfall, *Artificial precipitation, Cloud seeding, Silver iodide, Dispersion.

A metallic iodide, especially silver or lead iodide in the form of fine crystals, is suspended in an organic solvent such as acetone or ether, together with a dispersing agent, which may comprise sodium metasilicate. Upon atomizing the suspension in a moisture bearing atmospheric formation, such as a cloud, the solvent evaporates and releases the dispersed crystals while simultaneously chilling the crystals to the point that they become effective for inducing the formation of water droplets and subsequent precipitation. No combustion, with the accompanying development of heat is required. The dispersing agent maintains the crystals distributed in the solvent material so that the solution or suspension is uniform throughout. The composition is atomized into a cloud formation by expelling it under pressure through an atomizing nozzle. (Sinha - OEIS)
W80-05963

2C. Snow, Ice, and Frost

ARCTIC STREAM PROCESSES--AN ANNOTATED BIBLIOGRAPHY,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 10C.
W80-05712

THE ROLE OF SHEAR HEATING IN THE DYNAMICS OF LARGE ICE MASSES,
California Univ., Los Angeles. Dept. of Earth and Space Sciences.
D. A. Yuen, and G. Schubert.
Journal of Glaciology, Vol 24, No 90, p 195-212, 1979. 12 Fig, 2 Tab, 25 Ref, 1 Append. NSF EAR-77-15198.

Descriptors: *Ice, *Heating, *Creep, *Model studies, Shear, Temperature, Velocity, Activation energy, Theoretical analysis, Mathematical models, Movement, Analytical techniques, Physical properties, Profiles, Beds, Interfaces, Rheology, *Gravitational sliding, Ice sheets.

Self-consistent, steady, one-dimensional, subsolidus creep models of temperature and velocity were calculated for constant-thickness ice sheets sliding down a bed of constant slope under their own weight. Surface velocities of meters per year together with ice thickness of hundreds of meters can be realized by models wherein no melting occurs only if the activation energy for shear deformation E* is relatively small; a value of E* of about 60.7 kJ/mol (14.5 kcal/mol) is satisfactory, but an activation energy twice as large is not. Models which satisfy these constraints always lie close to the critical point which separates subcritical solutions (surface velocity u sub o and basal temperature T sub b increase with ice thickness h) from supercritical ones (u sub o, T sub b decrease with h). All steady states, whether subcritical or supercritical, are stable to perturbations of infinitesimal amplitude. However these ice layers are vulnerable to finite-amplitude frictional-heating instability which may be caused, for example, by sudden increases of glacier thickness. The superexponential growth-rates of such finite-amplitude instabilities may be responsible for the disintegration of large ice sheets in short periods of time. (Humphreys-ISWS)
W80-05735

THE MARGIN OF THE GREENLAND ICE SHEET AT ISUA,
Cold Regions Research and Engineering Laboratory, Hanover, NH.
S. C. Colbeck, and A. J. Gow.
Journal of Glaciology, Vol 24, No 90, p 155-165, 1979. 13 Fig, 1 Tab, 7 Ref.

Descriptors: *Ice, *Glaciology, *On-site investigations, Boreholes, Exploration, Temperature, Beds, Analysis, Velocity, Flow rates, Crystallography, Measurement, Profiles, On-site data collections, *Greenland, Ice sheet, Ice fabrics.

Field studies at a particular place at the margin of the Greenland ice sheet have provided information about the ice sheet. Ice temperatures were measured in five drill holes, two of which reached the unfrozen area of basal melting. Surface water entered these two boreholes, reaching the base in one, but remaining 59 m above the base in the other. The existence of this water conduit or fracture at 240 m depth, the calculated temperature profiles, and the local bedrock configuration suggest an area of stationary ice overridden by the ice sheet. This situation suggests creep rupture at depth in the ice sheet. Ice-fabric analysis made above 240 m depth shows patterns similar to fabrics elsewhere near the margin in zones of low deviatoric stress. Unfortunately no cores were obtained below that depth where stationary ice may exist. (Humphreys-ISWS)
W80-05736

CALCULATIONS OF VELOCITY AND TEMPERATURE IN A POLAR GLACIER USING THE FINITE-ELEMENT METHOD,
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
R. L. Hooke, C. F. Raymond, R. L. Hotchkiss, and R. J. Gustafson.
Journal of Glaciology, Vol 24, No 90, p 131-146, 1979. 6 Fig, 1 Tab, 24 Ref. NSF DPP74-19075,GA-42728,EAR77-21098.

Descriptors: *Ice, *Glaciology, *Model studies, Velocity, Flow rates, Temperature, Mathematical models, Analytical techniques, Finite element analysis, Shear, Stress, Strain, Mechanical properties, Deformation, Ice cap.

Numerical methods based on quadrilateral finite elements have been developed for calculating distributions of velocity and temperature in polar ice sheets in which horizontal gradients transverse to the flow direction are negligible. The calculation of the velocity field is based on a variational principle equivalent to the differential equations governing incompressible creeping flow. Glen's flow law relating effective strain-rate epsilon and shear stress tau by strain-rate = (tau/B) to the nth power was assumed, with the flow law parameter B varying from element to element depending on temperature and structure. As boundary conditions, stress may be specified on part of the boundary, in practice usually the upper free surface, and velocity on the rest. For calculation of the steady-state temperature distribution, Galerkin's method was used to develop an integral condition from the differential equations. The calculation includes all contributions from vertical and horizontal conduction and advection and from internal heat generation. Imposed boundary conditions are the temperature distribution on the upper surface and the heat flux elsewhere. The programs have been used to calculate velocity and temperature distributions in parts of the Barnes Ice Cap where extensive surface and borehole surveys provide information on actual values. The predicted velocities are in good agreement with measured velocities if the flow-law parameter B is assumed to decrease down-glacier from the divide to a point about 2 km above the equilibrium line, and then remain constant nearly to the margin. These variations are consistent with observed and inferred changes in fabric from fine ice with random c-axis orientations to coarser ice with single- or multiple-maximum fabrics. In the wedge of fine-grained deformed superimposed ice at the margin, B increases again. Calculated and measured temperature distributions do not agree well if measured velocities and surface temperatures are used in the model. The measured temperature profiles apparently reflect a recent climatic warming which is not incorporated into the finite-element model. These profiles also appear to be adjusted to a vertical velocity distribution which is more consistent with that required for a steady-state profile than the present vertical velocity distribution. (Humphreys-ISWS)
W80-05737

ICE-SHEET FLOW PROPERTIES DERIVED FROM BORE-HOLE SHEAR MEASUREMENTS COMBINED WITH ICE-CORE STUDIES,
Melbourne Univ., Parkville (Australia). School of Earth Sciences.
D. S. Russell-Head, and W. F. Budd.
Journal of Glaciology, Vol 24, No 90, p 117-130, 1979. 7 Fig, 28 Ref.

Descriptors: *Ice, *Mechanical properties, *Borehole geophysics, *Antarctic, *Glaciology, Flow, On-site investigations, Laboratory tests, Analysis, Shear, Deformation, Crystallography, Cores, Crystals, Velocity, Stress, Ice sheet, Isotropic ice.

A 345 m deep bore hole in ice about 385 m thick, near the edge of Law Dome, Antarctica, was drilled in 1974 about 3 km upstream from the site of a previous borehole, nearly reaching the bed, obtained in 1969. The core from this new borehole has been studied comprehensively, particularly with regard to the ice-crystal orientation fabrics. Samples of the ice core were subjected to simple shear at temperatures and deviatoric stresses which match the in situ conditions of the ice sheet. Similar studies of randomly oriented, laboratory-made polycrystalline ice were undertaken. Long-term tests, lasting for up to two years, were required to determine minimum strain-rates. The flow law for the anisotropic ice was thus determined as a function of that for the isotropic ice together with a measure of c-axis fabric strength perpendicular to the shear plane. Core studies indicate that the upper part of the ice sheet has a polycrystalline structure appropriate to the surface longitudinal stress. Deeper in the core a strong concentration of near-vertical c-axes develops. Ice having very large crystals with multiple maxima fabrics was found in the lower quarter of the ice thickness. Shear measurements in the borehole indicate the existence of high strain-rates in the zone of vertical c-axes, and of lower shear-rates below that level. The low values of shear-rates in the basal region cannot be explained in terms of crystallographic changes alone, and therefore it was inferred that the shear stress decreases in this layer--a result which also provides a possible explanation for the development of the observed basal crystal structure. (Humphreys-ISWS)
W80-05738

STABILITY OF TEMPERATE ICE CAPS AND ICE SHEETS RESTING ON BEDS OF DEFORMABLE SEDIMENT,
University of East Anglia, Norwich (England). School of Environmental Sciences.

G. S. Boulton, and A. S. Jones.
Journal of Glaciology, Vol 24, No 90, p 29-43, 1979. 7 Fig, 28 Ref.

Descriptors: *Glaciology, *Beds, *Model studies, *Ice, Movement, Glaciers, Mathematical models, Analytical techniques, Pleistocene epoch, Till, Sediments, Theoretical analysis, Analysis, Deformation, Interfaces, Erosion, Gravel bed, Till bed, Ice-bed interface.

Although theories of glacier movement generally assume that glaciers flow over rigid rock beds, there are many places where glaciers rest on beds of deformable sediment, and the great Pleistocene ice sheets which extended from time to time over much of Northern Europe and North America were largely underlain by such beds. Observations show that a large proportion of the forward movement of a glacier lying on such a bed may be contributed by deformation of the bed rather than the glacier. A theory was developed in which the glacier surface profile is related to the hydraulic and strength properties of potentially deformable bed materials. If these have a high hydraulic transmissibility, melt water is readily discharged subglacially, the bed is stable, and the profile is a normal parabolic one governed by the rheological properties of ice. If bed transmissibility is low, water pressures build up, the bed begins to deform, and a lower equilibrium profile will develop so that in an extreme case the glacier approximates to a thin flat sheet similar to an ice shelf. It was suggested that such behavior may have occurred at the margins of large Pleistocene ice sheets over North America and Europe, and evidence in support of this was drawn from the reconstructed shapes of these ice margins, anomalously small amounts of isostatic rebound, anomalously high retreat-rates, and the presence of glaciotectonic structures. Reasons were suggested to explain why this behavior should have been important for Pleistocene glaciers which penetrated into currently temperate latitudes but does not appear to be important in large modern glaciers. (Humphreys-ISWS)
W80-05740

INTERCEPTION OF VERTICAL AND HORIZONTAL PRECIPITATION IN THE FORESTS OF THE CENTRAL URAL,
Akademiya Nauk SSSR, Sverdlovsk. Inst. of Plant and Animal Ecology.
For primary bibliographic entry see Field 2B.
W80-05773

SEASONAL WATER SUPPLY FORECASTING FOR AREAS HAVING SEASONAL SNOWCOVER,
Idaho Univ., Moscow. Water Resources Research Inst.
T. B. Cline.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-207160, Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report, March 1980. 124 p, 13 Fig, 4 Tab, 13 Ref, 3 Append. OWRT A-065-IDA(1).

Descriptors: *Snow cover, *Runoff forecasting, *Water supply, *Computer models, Mathematical models, Snowmelt, Runoff, Surface runoff, Water equivalent, Melt water, Water sources, Seasonal, Fluctuations.

An iterative three-stage process model for forecasting seasonal runoff volume in basins subject to seasonal snowcover was developed as a tool for effective watershed management. More accurate water supply forecasts are valuable in power production, flood control, and agriculture. The model captures the essential cyclical character of streamflow dynamics in basins such as those in the Pacific Northwest. The model also has provisions for the effects of random weather and runoff fluctuations. The minimum variance of error forecast equations are recursive allowing for easy updating and small computer operational requirements. A dynamic model of monthly average streamflow with the important seasonal runoff characteristics was used to derive the minimum variance of error. The modeling procedure was applied to data from two different locations along the Boise River in south central Idaho, an area typical of other Northwest river basins subject to seasonal snowcover. This model has several advantages over previously used models; little computer storage is needed as only the previous year's streamflow records need to be kept in fast storage, manual tuning is not required, forcast equations for hourly and daily flows can be developed, and the forecasting equations, when properly implemented in software, are easy to learn to use. An extention of the model to include temperature and precipitation input will allow 'what if' questions to be more readily answered for better resource management decision-making. (Seigler-IPA)
W80-05808

THE EFFECT OF CRYSTAL SIZE AND DISPERSED-SOILD INCLUSIONS ON THE ACTIVATION ENERGY FOR CREEP OF ICE,
Wisconsin Univ. River Falls. Dept. of Plant and Earth Sciences.
R. W. Baker, and W. W. Gerberich.
Journal of Glaciology, Vol 24, No 24, 90, p 179-194, 1979. 4 Fig, 4 Tab, 40 Ref. NSF GA-19310, GA-42728, EAR-7712981, EAR7901761.

Descriptors: *Ice, *Creep, *Laboratory tests, *Glaciology, Crystals, Model studies, Temperature, Particle size, Mathematical models, Analysis, Analytical techniques, Flow, Movement, Deformation, Mechanical properties, Data collections, Strain, Measurement, Activation energy, Polycrystalline ice, Ice flow, Creep rate.

Steady-state creep-rate of polycrystalline ice were investigated as a function of temperature, grain-size, and inclusion concentration throgh uniaxial compression in the laboratory. Sample were run at a constant load with the temperature systematically varied between about -5C and -40C. The presence of inclusions inhibits dynamic recrystallization and grain growth; the average crystal size produced by recrystallization was inversely proportional to the inclusion concentration. At temperatures above -8C, creep-rate was enhanced by about a factor of two. This appears to be the result of the combined effects of recrystallization with accompanying grain growth and grain-boundary sliding. Over the temperature range -10C to -40C, the apparent activatione energy for creep increases with increasing volume fraction of inclusions. This is apparently due to a thermally activated process which is modified by internal stresses created by the inclusions. (Humphreys-ISWS)
W80-05828

THE USE OF A RATIONAL MODEL IN THE MATHEMATICAL ANALYSIS OF A POLYTHERMAL GLACIER,
Trinity Coll., Dublin (Ireland). School of Mathematics.
A. C. Fowler.
Journal of Glaciology, Vol 24, No 90, p 443-456, 1979. 4 Fig, 17 Ref.

Descriptors: *Glaciers, *Model studies, *Ice, Movement, Mathematical models, Flow, Equations, Analytical techniqus, Analysis, Temperature, Theoretical analysis, Melting, *Polythermal glaciers, *Sliding, Ice flow.

The process was described by which a complex model set of equations and boundary conditions may be rationally reduced to a simple and more manageable set by the process of nondimensionalization and asymptotic approximation. Such a reduced model was then presented for an incompressible, two-dimensional ice flow. It consists of two coupled equations for the stream function and enthalpy variable, together with a complex set of bondary conditions. The important dimensionless parameters which arise were given, and various limiting values of these were commented on. Nye's equation for kinematic waves may be reproduced, and a nonlinear analysis of this reveals that disturbances reach the glacier snout in finite time and are uniformly bounded there: in the particular case considered, one can also show that the temperature field is stable. It was shown that the effect of introducing a (realistic) sliding law which is continuously dependent on the temperature has a major effect on the bedrock temperature profile. Lastly seasonal waves were considered using a kinematic wave equation based on a plausible form of the sliding law when cavitation is present. The main observed features were qualitatively reproduced. (Humphreys-ISWS)
W80-05831

DEDUCTION OF GLACIER FLOW FROM THE DISTRIBUTION OF ELONGATED BUBBLES,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
M. Nakawo.
Journal of Glaciology, Vol 24, No 90, p 457-467, 1979. 11 Fig, 13 Ref.

Descriptors: *Glaciers, *Flow, *On-site investigations, Ice, Laboratory tests, Methodology, Strain, Movement, Foreign research, Analytical techniques, Analysis, Deformation, Measurement, Velocity, *Nepal, *Elongated bubbles, G2 Glacier(Nepal), Bubble foliation.

The elongation of air bubbles discovered in a wide area of a glacier surface covered by supraglacial debris does not coincide with the direction of flow. When ice samples including elongated bubbles were subjected to simple-shear experiments, the elongated bubbles deformed passively with ice, and their final orientation was a good indicator of the strain induced in the ice. Based on these experimental results, the strain and the velocity field of the glacier were deduced from the distribution pattern of the elongated bubbles. The results agreed with the measured flow velocity. The bubble foliation pattern could also be explained in terms of the passive deformation. (Humphreys-ISWS)
W80-05834

EVALUATION OF PRACTICES IN WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
M. E. Hawley, R. H. McCuen, and R. E. Moreland.
Water Resources Bulletin, Vol 15, No 2, p271-278, April 1980. 11 TaB, 5 Ref.

Descriptors: *Snowmelt, *Forecasting, *Model studies, *Statistical methods, Water supply, Floods, Flood control, Runoff, Precipitation(Atmospheric), Snowfal, Snow cover, Watersheds(Basins), Lakes, Regression analysis, Evaluation, Hydrology, Water supply forecasting.

Snowmelt runoff is a primary source of water supply in much of the western United States. Multipurpose planning requires long-range forecasts, and the accuracy of the forecasts has a significant effect on economic benefits. In an effort to increase the accuracy of snowmelt runoff forecasts, selected practices in water supply forecasting were evaluated. These practices included: (1) using multiple regression in developing forecasting models, (2) using a model that was calibrated to make forecasts on April 1 for making forecasts at other times, (3) using maximum snow water equivalent measurements in forecast equations, and (4) using weighted equivalent meaurements for making forecasts. The results of a case study indicated that forecasting accuracy is significantly affected by these practices. Goodness-of-fit statistics may not be indicative of the accuracy of forecasts when the prediction equations are used to make forecasts for dates other than those used in calibration. The use of maximum snow water equivalent measurements and weighted averages did not improve forecast accuracy. (Sims-ISWS)
W80-05857

CHARACTERIZATION AND TREATMENT OF SNOWMELT RUNOFF FROM AN URBAN CATCHMENT,
Ontario Ministry of the Enviroment, Toronto. Wastewater Treatment Section.
For primary bibliographic entry see Field 2E.
W80-05860

A FIELD STUDY OF BRINE DRAINAGE AND OIL ENTRAINMENT IN FIRST-YEAR SEA ICE,
Washington Univ., Seattle. Dept. of Oceanography.
S. Martin.
Journal of Glaciology, Vol 22, No 88, p 473-502, 1979. 26 Fig, 13 Ref. ONR N00014-76-C-0234.

Descriptors: *Sea ice, *Oil pollution, *On-site investigations, Entrainment, Oil, Ice, On-site data collections, Frazil ice, Physical properties, Brines, Salinity, Temperature, Analysis, Cores, Sampling, Snow cover, Brine drainage, Ice cores.

From field observations, this paper described the growth and development of first-year sea ice and its interaction with petroleum. In particular, when sea ice initially forms, there is an upward salt transport so that the ice surface has a highly saline layer regardless of whether the initil ice is frazil, columnar, or slush ice. When the ice warms in the spring, because of the eutectic condition, the surface salt liquifies and drains through the ice leading to the formation of top-to-bottom brine channels and void spaces in the upper part of the ice. If oil is released beneath winter ice, the oil becomes entrained in thin lenses within the ice. In the spring, this oil flows up to the surface through the newly opened brine channels and distributes itself within the brine-channel feeder systems on the ice surface and in horizontal layers in the upper part of the ice. The paper showed that these layers probably form from the interaction of the brine drainage with the percolation of melt water from surface snow down into the ice and the rise of the oil from below. Finally in the summer, the oil on the surface leads to melt-pond formation. The solar energy absorbed by the oil on the surface of these melt ponds eventually causes the melt pond to melt through the ice, and the oil is again released into the ocean. (Humphreys-ISWS)
W80-05937

EQUILIBRIUM PROFILE OF ICE SHELVES,
British Antarctic Survey, Cambridge (England).
T. J. O. Sanderson.
Journal of Glaciology, Vol 22, No 88, p 435-460, 1979. 11 Fig, 2 Tab, 218 Ref.

Descriptors: *Ice, *Glaciology, *Model studies, *Sea ice, *Bays, Theoretical analysis, Mathematical models, Analytical techniques, Profiles, Equilibrium, Creep, Strain, Movement, Velocity, Temperature, Deformation, Shape, Equations, Mathematical studies, Ice shelves, Bay ice shelves.

Using expressions for ice-shelf creep derived by Weertman and by Thomas, the author developed a general method for calculating equilibrium thickness profiles, velocities, and strain-rates from any ice shelf. This was done first for an unconfined glacier tongue, and the result agrees well with data for Erebus Glacier tongue (Holdsworth, 1974). Anomalies occur within the first 3 km after the hinge zone, and these are too great to be the result of local bottom freezing; they are probably due to disturbance of the velocity field. Secondly, profiles were calculated for bay ice shelves. Thickness gradients are largely independent of melt-rate of flow parameters but are inversely proportional to the width of the bay. Data from Antarctic ice shelves agree with this result both qualitatively and quantitatively. The theory was readily extended to ice shelves in diverging and converging bays. An ice shelf in a diverging bay can only remain intact if it is thick enough and slow enough to creep sufficiently rapidly in the transverse direction. If it cannot, it will develop major rifts or will come adrift from the bay walls. It is then likely to break up. The presence of ice rises or areas of grounding towards the seaward margin can radically alter the size of the ice shelf that can form. The theory could be used as a starting point to study nonequilibrium behavior. (See also W73-09088 and W75-00765) (Humphreys-ISWS)
W80-05938

WINTERTIME FLOW DISTRIBUTION IN RIVER CHANNELS,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W80-05951

2D. Evaporation and Transpiration

APPARENT TRANSPIRATIONAL RHYTHMS OF AVICENNIA MARINA (FORSK.) VIERH. AT INHACA ISLAND, MOCAMBIQUE,
Durban-Westville Univ. (South Africa). Dept. of Botany.
T. D. Steinke.
Journal of South African Botany, Vol 45, No 2 p 133-138, 1979. 4 Fig, 4 Ref.

Descriptors: *Transpiration, *Mangrove swamps, *Stomata, *Transpiration control, Biorhythms, Cycles, Diurnal, Aquatic plants, Humidity, Temperature, Tidal effects, Tidal marshes, Moisture deficit, Leaves, Plant physiology, *South Africa.

A summer study of the pattern of transpiration in Avicennia marina, a common mangrove of coastal South Africa, confirmed the general transpirational rhythm which has been previously established. The Ponta Rasa mangrove swamp with young, healthy trees 2 to 3 m tall, bearing immature propugules was used for the study. The potometric method was used with values representing mean readings from two potometers attached to adjacent trees. Reading were taken hourly from just after sunrise to just before sunset. Temperature and humidity readings were also taken. The weather during the study period was hot with very little wind. Transpiration rates between 'wet' and 'dry' sites were compared using trees 40 m apart. Results show that the rate of transpiration increased until 10h00, then steadily decreased. Spring tides had no effect in reversing the decrease in the late afternoon. No significant difference in transpiration rate was found between trees growing in 'dry and 'wet' areas. Also, the water deficit caused be high temperatures is of overriding importance causing stomatal closure even in bright light. Contrary to previous conclusions, no temporary increase in transpiration rate was seen with the incoming tide. (Seigler-IPA)
W80-05865

2E. Streamflow and Runoff

PROBABILITY WEIGHTED MOMENTS COMPARED WITH SOME TRADITIONAL TECHNIQUES IN ESTIMATING GUMBEL PARAMETERS AND QUANTILES,
Geological Survey, Reston, VA. Water Resources Div.
J. M. Landwehr, N. C. Matalas, and J. R. Wallis.
Water Resources Research, Vol 15, No 5, p 1055-1064, October 1979. 11 Tab, 6 Ref.

Descriptors: *Probability, *Statistical methods, *Estimating, *Flood frequency, *Hydrology, Monte Carlo method, Stochastic processes, *Probability weighted moments, *Gumbel parameters and quantiles.

Estimates of the parameters and quantiles of the Gumbel distribution by the methods of probability weighted moments, (conventional) moments, and maximum likelihood were compared. Results were derived from Monte Carlo experiments by using both independent and serially correlated Gumbel numbers. The method of probability weighted moments was seen to compare favorably with the other two techniques. (Kosco-USGS)
W80-05703

ANALYSIS OF ARIZONA FLOOD DATA NETWORK FOR REGIONAL INFORMATION,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-05706

SYNTHETIC HYDROLOGY AND WATER SUPPLY RELIABILITY,
Geological Survey, Reston, VA. Water Resources Div.
R. M. Hirsch.
Water Resources Research, Vol 15, No 6, p 1603-1615, December 1979. 3 Fig, 12 Tab, 21 Ref.

Descriptors: *Synthetic hydrology, *Water supply, *Water management(Applied), *Streamflow, Evaluation, Statistical methods, Model studies, Methodology, Mathematical models, Estimating, Probability, *Synthetic streamflow generators, *Autoregressive-moving average model.

Synthetic hydrology is a tool that may be used in evaluating the consequences of water supply management decisions. Given that there are many proposed generating methods for synthetic hydrology, it is necessary to evaluate the performance of various synthetic streamflow generators (SSG's). Six different single site, monthly generators are considered here. The comparison demonstrates that preservation of statistical moments (mean, standard deviation, and lag correlation coefficients) may be a misleading criterion for judging the ability of SSG to provide plausible estimates of water supply system performance. Specification of marginal distributions of monthly streamflows based on transformed values of historical streamflow data rather than on the data itself is shown to be operationally superior. Two transformations are considered, the log, transform and a newly developed normalizing transform. A new type of autoregressive-moving average model is shown to be operationally superior to an autoregressive model. (Kosco-USGS)
W80-05711

SPACE, TIME, AND THE THIRD DIMENSION (MODEL ERROR),
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-05713

AN EVALUATION OF SOME RECORD RECONSTRUCTION TECHNIQUES,
Geological Survey, Reston, VA. Water Resources Div.
R. M. Hirsch.
Water Resources Research, Vol 15, No 6, p 1781-1790, December 1979. 6 Fig, 4 Tab, 10 Ref.

Descriptors: *Streamflow, *Estimating, *Regional analysis, *Networks, *Evaluation, Analytical techniques, Methodology, Hydrologic data, Stream gages, Sites, Statistical methods, Correlation analysis, Least squares method, *Record reconstruction techniques.

There are many methods available for reconstructing streamflow records for sites where no record or only a short record exists. The methods described and evaluated herein rely on transfer of information from nearby stream gages. The methods involve: (1) the use of drainage area ratios; (2) the use of estimates of monthly means and standard deviations based on regional streamflow-basin characteristics models; and (3) two different methods of using the cross-correlation of flow records. The methods are evaluated in terms of their ability to estimate some statistics of the annual yields of a reservoir located at the site for which the record is reconstructed. The analysis indicates that useful estimates of flows and reservoir yields may be made without any at-site measurements, provided that good regional information transfer models are available. (Kosco-USGS)
W80-05714

BACKWATER AT BRIDGES AND DENSELY WOODED FLOOD PLAINS, YOCKANOOKANY RIVER NEAR THOMASTOWN, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Colson, C. O. Ming, and G. J. Arcement.
Available from Br. of Dist, USGS 1200 S. Eads St. Arlington, VA., price $11.25. Geological Survey Hydrologic Investigations Atlas HA-599, 1979. 9 Sheets, 4 Fig, 2 Tab, 10 Ref.

Descriptors: *Floodflow data, *Flood flow, *Data collections, *Model studies, *Open channel flow,

Streamflow, Peak discharge, Flood plains, Alabama, Louisiana, Mississippi, Flood profiles, Bridges, Backwater, Flow around objects, Streamflow forecasting, Analytical techniques, Vegetation, Embankments, Forest watersheds, Mannings equation, Digital computers, Evaluation, *Yockanookany River(MS).

Floodflow data that will provide a base for evaluating digital models relating to open-channel flow were obtained at 22 sites on streams in Alabama, Louisiana, and Mississippi. Thirty-five floods were measured. Analysis of the data indicated methods currently in use would be inaccurate where densely vegetated flood plains are crossed by highway embankments and single-opening bridges. This atlas presents flood information at the site on Yockanookany River near Thomastown, Miss. Water depths, velocities, and discharges through bridge openings on Yockanookany River near Thomastown, Miss., for floods of April 12, 1969, January 2, 1970, and March 15, 1975, are shown, together with peak water-surface elevations along embankments and along cross sections. Manning's roughness coefficient values in different parts of the flood plain are shown on maps, and flood-frequency relations are shown on a graph. (Kosco-USGS)
W80-05721

LATERAL WEIR FLOW MODEL,
Concordia Univ., Montreal (Quebec). Dept. of Civil Engineering.
A. S. Ramamurthy, and L. Carballada.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 106, No IR1, Proceedings Paper 15285, p 9-25, March 1980. 13 Fig, 2 Tab, 13 Ref, 2 Append.

Descriptors: *Discharge(Water), *Weirs, *Model studies, Discharge coefficient, Hydraulics, Irrigation systems, Open channel flow, Conduits, Theoretical analysis, Channel flow, Flow, Mathematical studies, *Lateral weir, Lateral flow, Conduit outlet.

The theory of flow through a lateral conduit outlet was adopted to derive an expression for the discharge coefficient of the flow through a lateral weir set in a rectangular channel. The theoretical expressions hold good for subcritical flow in the channel upstream of the weir. The experimental data obtained in a test flume provided a verification of the theoretical relationships between the geometric and fluid dynamic parameters of the weir flow. The proposed relationships are valid for flow through lateral weirs that can be as wide as the parent channel. (Lee-ISWS)
W80-05733

SUMMER FLOODING AT CHICAGO AND POSSIBLE RELATIONSHIPS TO URBAN-INCREASED HEAVY RAINFALL,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2B.
W80-05766

C & D CANAL EFFECT ON SALINITY OF DELAWARE ESTUARY,
Najarian, Thatcher and Associates, Inc., Demarest, NJ.
For primary bibliographic entry see Field 2L.
W80-05777

SEASONAL WATER SUPPLY FORECASTING FOR AREAS HAVING SEASONAL SNOW-COVER,
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 2C.
W80-05808

RELATIONSHIPS BETWEEN METABOLIC PARAMETERS AND STREAM ORDER IN OREGON,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 2K.
W80-05813

FRICTION SLOPE MODELS FOR M2 PROFILES,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W80-05817

THE RED RIVER FLOOD CONTROL SYSTEM AND RECENT FLOOD EVENTS,
Winnipeg Univ. (Manitoba). Dept. of Geography.
W. F. Rannie.
Water Resources Bulletin, Vol 16, No 2, p 207-214, April 1980. 5 Fig, 1 Tab, 22 Ref.

Descriptors: *Flood control, *Floods, *Flood protection, *Canada, Rivers, Floodwater, Reservoirs, Dikes, Floodways, Diversion, Hydrology, Flood recurrence interval, Discharge(Water), *Red River of the North, *Manitoba, Diversion channels.

The 1950 flood disaster in the Red River Valley, Manitoba, and particularly in Winnipeg made all levels of government aware of the need for control measures. The principal elements of the system which was implemented were two large excavated diversion channels, a storage reservoir, and ring dikes around several small communities. In terms of cost and size, the flood control system is the largest in Canada, and despite federal contributions amounting to nearly 60% of the final cost, it represented a considerable fiscal burden for the comparatively small population of Manitoba. Between the opening of the Red River Floodway in 1968 and 1979, a series of exceptional spring peak flows on the Red and Assiniboine Rivers demonstrated the benefits of such a system to a degree which could not have been anticipated at the time the projects were being considered. Furthermore, maximum spring discharges from 1913 to 1978 show a clear rising trend, indicating that the flood hazard is becoming even more severe than was initially assumed; if this trend continues, future benefits will continue to exceed expectations. The overall effectiveness of the hazard reduction program in the Red River Valley, however, has suffered from continued development in unprotected areas. Recent federal-provincial agreements have been reached which will substantially reduce this problem and place greater emphasis on improving the nonstructural components of an overall flood hazard reduction program. (Humphreys-ISWS)
W80-05818

APPROXIMATE METHOD FOR QUICK FLOOD PLAIN MAPPING,
Army Engineer District, Mobile, Al.
R. F. Powell, L. D. James, and D. E. Jones, Jr.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol. 106, No. WR1, Proceedings Paper 15243, p 103-122, March 1980. 11 Fig, 5 Tab, 17 Ref, 1 Append.

Descriptors: *Floods, *Mapping, *Flood frequency, Flood control, Damages, Flood damages, Hazards, Flood peak, Flood plains, Flood plain zoning, Flood recurrence interval, Maps Planning, Analytical techniques.

Flood hazard must be quantitatively defined to guide individual land use and construction decisions as well as zoning and building code regulations. An approximate method for defining flood risk was presented for the purposes of: (1) making initial estimates to guide interim decisions prior to the completion of more thorough studies, and (2) checking completed studies for reasonableness. Since most stream cross sections and flow-frequency relationships are smooth curves, the stage-frequency curve can be extrapolated to rarer events from the relatively easier-to-obtain data on common events. Annual flood peaks and rating curves for 51 USGS stream gages with over 50 yr of record were used to develop curves 'normalized' with respect to the elevation difference between the crest stages of the 10-yr and 25-yr events. Flood stages were estimated for 37 other streams from these normalized curves, and the results compare favorably with those achieved through more thorough studies. Limitations of the method were considered. (Sims-ISWS)
W80-05823

DIMENSIONLESS GRAPHS OF FLOODS FROM RUPTURED DAMS,
Hydrologic Engineering Center, Davis, CA.
J. G. Sakkas.
Research Note No 8, April 1980. 70 p, 3 Tab, 7 Ref, 4 Append.

Descriptors: *Dam failure, *Floods, *Mathematical models, *Flood waves, Open channel flow, Rivers, Rupturing, Model studies, Hydraulics, Flood routing, Analytical techniques, Analysis, Flood peak, Flood profiles, Celerity, Methodology, Channels, Unsteady flow, Steady flow.

The dimensionless curves presented in this report are intended for use in routing the dam-break flood down a dry prismatic channel. Three important properties of the flood wave may be determined: time of arrival of the wave front, maximum flood depth, and time of maximum flood depth. The routing curves were prepared from the results of numerical simulation experiments which solved a dimensionless form of the St. Venant equations. The propagation of the flood wave tip along the dry valley floor was calculated, as well as propagation of the negative wave as it was reflected from the upstream boundry of the reservoir. It was possible to express the results on the form of dimensionless graphs because valley geometery was expressed as a simple, prismatic channel. In utilizing these graphs, it is necessary to transform the irregular natural cross-sections into one representative prismatic section. The important properties which must be preserved are storage and conveyance. Three basic forms of cross-section shape are permitted: rectangular, triangular, and parabolic. The equation for expressing the properties of each of these forms, as well as other equations necessary to utilize the dimensionless graphs, were presented in Annex I. (Humphreys-ISWS)
W80-05829

GUIDELINES FOR CALCULATING AND ROUTING A DAM-BREAK FLOOD,
Hydrologic Engineering Center, Davis, CA.
D. L. Gundlach, and W. A. Thomas.
Research Note No. 5, January 1977. 56 p 1 Fig, 2 Tab, 8 Ref, 2 Append.

Descriptors: *Dam failure, *Flood profiles, *Model studies, Waves(Water), Open channel flow, Flood routing, Mathematical models, Analytical techniques, Analysis, Hydrographs, Hydrograph analysis, Water levels, Discharge(Water), Reservoirs, Peak discharge, Rupturing, Unsteady flow, Steady flow, *Teton Dam, Partial breaks.

This report described procedures necessary to calculate and route a dam-break flood using an existing generalized unsteady open channel flow model. The recent Teton Dam event was reconstituted to test the model's performance on such a highly dynamic wave. The procedures outlined relate, primarily, to partial breaches. Some deficiencies in the model were identified which will require some further research and programming to improve the applicability of the program to dam-break flood events. The special project memo established four objectives for this study. The first two, (1) level of accuracy of existing techniques and (2) sensitivity of calculated results to n-values and breach size, were summarized and presented in detail in Appendix A. The third objective, (3) description of physical phenomena controlling depth and travel time and a discussion of pertinent field data, was presented in the body of this report. The fourth objective, (4) documentation of the methodology, was included in Appendix B. Computer programs utilized in the metodology may be obtained from The Hydrologic Engineering Center. The computer program was applied to the Teton Dam data set to demonstrate the level of accuracy one might expect in such analyses. The results were shown and, in general, appear reasonable. (Humphreys-ISWS)
W80-05830

COMPARISON OF MUSKINGUM METHOD DIFFERENCE SCHEMES,
Florida Univ., Gainesville. Dept. of Civil Engineering.
A. D. Koussis.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Technical Note, p 925-929, May 1980. 7 Ref, 1 Append.

Descriptors: *Flood routing, *Mathematical models, *Numerical analysis, Analytical techniques, Finite element analysis, Model studies, Equations, Analysis, Flood waves, Taylor-series analysis, Propagation time.

This note centered on the issue of numerical precision as affected by the use of different routing schemes. The investigation was prompted by the observation that in an application of the Kalinin-Miljukov method, accuracy improved when a more refined difference scheme was used in place of the conventional one. Test calculations indicated that if the weighting coefficient theta is adjusted individually for each scheme, results are of essentially the same accuracy, but that the more refined scheme is less sensitive to the dip at the beginning of the outflow hydrograph for theta not equal to 0. Computations indicated that for a fixed value of theta and r less than 1 the latter is roughly equivalent to a third-order approximation of the former. The value of r was defined as the ratio (time discretion interval)/(average propagation time of the wave through the reach). Suggestions were made regarding the selection of a routing method based on the availability of data. (Humphreys-ISWS)
W80-05843

LINEAR RESERVOIRS AND NUMERICAL DIFFUSION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W80-05846

TIME-DEPENDENT STOCHASTIC MODEL OF FLOODS,
Ecole Polytechnique Federale de Lausanne (Switzerland). Laboratoire d'Hydraulique.
M. North.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Proceedings Paper 15405, p 649-665, May 1980. 9 Fig, 1 Tab, 12 Ref, 2 Append.

Descriptors: *Floods, *Stochastic processes, *Model studies, *Mathematical models, Probability, Statistical models, Equations, Analytical techniques, Estimating equations, Flow, Rivers, Hydrography, Hydrology, *Switzerland.

The proposed model was based on the streamflow partial duration series (PDS). Both the occurrence time and the magnitude of the floods (instantaneous hydrograph peaks) were time-dependent random variables. An estimation method, based on the maximum likelihood concept, was also proposed. The derivation of the law of extremes from the basic model showed the strong influence of the time-dependence assumptions on the extreme values. Application of the model to a 38-yr series of floods on the Melezza River at Camedo, Ticino (Southern Switzerland), showed good agreement between theoretical and observed values. (Sims-ISWS)
W80-05847

THE EFFECTS OF RECENT CHANGES IN ATMOSPHERIC CIRCULATION ON THE HYDROLOGY OF THE KANKAKEE RIVER,
Indiana Univ. at Bloomington. Dept. of Geography.
For primary bibliographic entry see Field 2B.
W80-05855

CHARACTERIZATION AND TREATMENT OF SNOWMELT RUNOFF FROM AN URBAN CATCHMENT,
Ontario Ministry of the Enviroment, Toronto. Wastewater Treatment Section.
H. Kronis.
Research Publication No 73, December 1978. 40p, 6 Fig, 10 Tab, 15 Ref.

Descriptors: *Snowmelt, *Runoff, *Water treatment, *Drainage, *Water pollution, Storm drains, Urbanization, Canada, Chlorides, Suspended solids, Sedimentatin, Flow rates, Flocculatin, Water sampling, Monitoring, Laboratory equipment, Coliforms, Trace elements.

The physical-chemical treatment and characterization of snowmelt runoff from an urban catchment in East York, Toronto, Ontario, were investigated during the winter of 1977/78. Two types of snowmelts were encountered: (1) true snowmelt (induced by salt or warm weather); and (2) snowmelt/stormater (induced by rain). Automated sampling and flow monitoring systems were installed in the storm sewers and bench-scale and pilot plant equipment were used to test natural and chemical assisted flocculation. The flow-rate of the snowmelt runoff was only about 8 L/s which is insignificant when compared to rain-caused runoff. Snowmelt/stormwater runoff rates were higher and more variable, but they did not exceed 80 L/s. Road salting resulted in very high initial chloride concentrations (up to 18,200 mg/L) which declined slowly until it reached rain-caused levels and the runoff contained little colloidal suspended material. Pollution reduction by chemical flocculation was high while natural settling produced little effect on pollution levels. Some reduction in bacterial levels resulted from the alum flocculation treatment. Indicator bacterial levels were lower for snowmelt runoff than for rain-caused runoff. Eight trace metals were analyzed in the snowmelt runoff and only lead showed any elevated concentrations. (Sidney-IPA)
W80-05860

ANNUAL AND SEASONAL LOW-FLOW CHARACTERISTICS OF IOWA STREAMS,
Geological Survey, Iowa City, IA. Water Resources Div.
O. G. Lara.
Geological Survey Open-file report 79-555, March 1979. 307 p, 4 Fig, 4 Plates, 10 Ref.

Descriptors: *Streamflow, *Low-flow, *Hydrologic data, *Water resources, *Iowa, Mississippi River, Missouri River, Gaging stations, Flow rates, Data collections, Stream gages, Discharge measurement, Duration curves, Hydrographs, Flow characteristics, Average flow, Frequency analysis, Maps, Precipitation(Atmospheric), Runoff, Historical data.

The low-flow characteristics of Iowa streams are described by annual and seasonal low-flow frequency and duration data. Tabulated in this report are low-flow data collected at 135 gaging stations on Iowa streams, three on the Mississippi River, four on the Missour River, and 426 partial-record sites. The information contained in this report is based on all of the daily discharge records collected by the U.S. Geological Survey through the 1976 water year. Consideration is given to the regional aspects of low-flow characteristics by including regression equations to estimate the average discharge and generalized maps to estimate the 7-day, 2-year and 7-day, 10-year discharges at ungaged sites. (Kosco-USGS)
W80-05866

ESTIMATION OF PARAMETERS AND QUANTILES OF WAKEBY DISTRIBUTIONS. 1. KNOWN LOWER BOUNDS,
Geological Survey, Reston, VA. Water Resources Div.
J. M. Landwehr, N. C. Matalas, and J. R. Wallis.
Water Resources Research, Vol 15, No 6, p 1361-1372, December 1979. 14 Tab, 9 Ref.

Descriptors: *Statistical methods, *Estimating, *Flood frequency, Distribution patterns, Analytical techniques, Mathematical studies, Equations, Monte Carlo method, *Wakeby distribution.

An algorithm based on the use of probability weighted moments allows estimation of the parameters of the Wakeby distribution. In the case where the lower bound is known, the quantile estimates, unlike the parameter estimates, tend to be neither highly biased nor highly variable, even for samples of small size (n = 5). (Kosco-USGS)
W80-05873

ESTIMATION OF PARAMETERS AND QUANTILES OF WAKBY DISTRIBUTIONS. 2. UNKNOWN LOWER BOUNDS,
Geological Survey, Reston, VA. Water Resources Div.
J. M. Landwehr, N. C. Matalas, and J. R. Wallis.
Water Resources Research, Vol 15, No 6, p 1373-1379, December 1979. 11 Tab, 8 Ref.

Descriptors: *Statistical methods, *Estimating, *Flood frequency, Distribution patterns, Analytical techniques, Mathematical studies, Equations, Monte Carlo method, *Wakeby distribution.

An algorithm based on the use of probability weighted moments allows estimation of the parameters, hence quantiles, of the Wakeby distribution. For the case where the lower bound is not know, the performance of the algorithm using unbiased estimates of the probility weighted moments is compared to that using biased estimtes. The chocie of estimating algorithm, determined as that which minimizes the root mean square error of the quantiles, appears to be unimportant when the upper (flood) quantiles are of interest and the lower bound is not known, in contrast to the lower (drought) quantiles. (Kosco-USCG)
W80-05874

FLOOD-PRONE AREA MAPS AT THREE SITES ALONG THE TRANS-ALASKA PIPELINE, ALASKA,
Geological Survey, Anchorage, AL. Water Resources Div.
R. D. Lamke, and S. H. Jones.
Available from OFSS, Box 25425, Fed. Ctr. Denver, CO. 80225, Paper copy $2.00, microfiche $3.50. Geological Survey open-file report 80-209, 1980. 14 p, 8 Fig, 1 Tab, 8 Ref.

Descriptors: *Flood plans, *Maps, *Alaska, *Land use, *Land development, Regional analysis, Gaging stations, Sites, Flood peak, Flood frequency, Flood data, Aerial photography, Sagavanirktok River(Alaska), Middle Fork Koyukuk(Alaska), Jim River(Alaska).

Flood-prone areas in Alaska are delineated on aerial photographs for the Sagavanirktok River near Pump Station 3, Middle Fork Koyukuk River at Coldfoot, and Jim River near Pump Station 5. An analysis of available flood data and a description of recent flood evidence and maximum evident flood marks are included. (Kosco-USGS)
W80-05875

A PLAN FOR STUDY OF FLOOD HYDROLOGY OF FOOTHILL STREAMS IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. F. McCain, and J. J. Ebling.
Available OFSS, Box 25425, Fed. Ctr. Denver, CO. 80225, Paper copy $6.00, microfiche $4.00. Geological Survey open-file report 79-1276, September 1979. 29 p, 1 Fig, 1 Plate, 7 Rab, 69 Ref.

Descriptors: *Flood forecasting, *Natural streams, *Colorado, *Hydrologic data, *Flow characteristics, Methodology, Regional analysis, Flood frequency, Rainfal-runoff relationships, Peak discharge, Gaging stations, Model studies, Analytical techniques, Flood recurrence interval, Geomorphology, *Foothill streams(CO).

A comprehensive plan is presented for researching methods of flood-data analysis and informatin transfer for foothill areas, and for establishing a hydrologic data-collection network in the foothill areas of Colorado. The research will concentrate on three areas: (1) Developing methods to analyze flood peaks in foothill areas by using gaging-station records to obtan annual arrays of snowmelt and

rainfall peaks; (2) investigating techniques for flood informatin transfer, using physical and climatic characteristics; and (3) testing and, if required, verifying hydrologic models. The available gaging-station data consists of records from 81 active and 43 discontinued gaging stations. The National Weather Service operates 53 recording and 70 non-recording precipitation gages, and has 476 storm observers within the project boundaries. The Soil Conservation Service is installing a network (SNOTEL) of 46 automated snowpack monitors. A data-collection network will be established in areas of data deficiencies, consisting of streamflow stations, crest-stage gages, and precipitation stations. (Kosco-USGS)
W80-05876

STREAMFLOW ESTIMATES IN SELECTED WISCONSIN STREAMS,
Geological Survey, Madison, WI. Water Resources Div.
R. P. Novitzki.
Available from OFSS, Box 25425, Fed. Ctr. Denver, CO. 80225, Price, $2.00, microfiche $3.50. Geological Survey open-file report 79-1282, October 1979. 11 p, 4 Fig, 3 Tab, 2 Ref.

Descriptors: *Streamflow, *Estimating, *Wisconsin, *Streams, *Average flow, Lake basins, Rehabilitation, Feasibility studies, Statistical methods, Streamflow forecasting, Discharge measurement, Gaging stations.

The Wisconsin Department of natural Resources needs streamflow information in lake basins where lake-rehabilitation programs are implemented but where long-term stream-gaging stations are not justified. The U.S. Geological Survey provided streamflow estimates for 24 streams in Wisconsin. The estimates were made by the use of (1) mid-monthly measurements, (2) basin characteristics, and (3) drainage-area-discharge relations. The mid-monthly measurement technique probably provides the best estimtes of streamflow in streams that may be affected by storage in lakes. However, it is costly, requires 1 year of measurements, and results cannot be obtained until streamflow data from gaging stations in the area have been processed. The basin-characteristics technique is quicker and provides good estimates, but defining the basin parameters is difficult. The drainage-area-discharge technique also provides good streamflow estimates, and it is quick, convenient, and inexpensive. However, the streamflow estimates obtained from drainage-area-discharge relations may be biased because the technique is based on gaging-station records for large steams that do not have the variability of smaller streams and that typically do not reflect the influence of lake storage. (Kosco-USGS)
W80-05878

APPLICATION OF THE HEC-5 HYDROPOWER ROUTINES,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 4A.
W80-05927

ADOPTION OF FLOOD FLOW FREQUENCY ESTIMATES AT UNGAGED LOCATIONS,
Hydrologic Engineering Center, Davis, CA.
M. W. Burnham.
Training Document No 11, February 1980. 47 p, 1 Fig, 7 Ref, 2 Append.

Descriptors: *Flood flow, *Flood frequency, *Frequency curves, *Estimating, Flood discharge, Hydrograph analysis, Discharge(Water), Analytical techniques, Hydrologic aspects, Watersheds(Basins), Precipitation(Atmospheric), Ungaged locations.

The purpose of this paper was to present the concept of adopting flood flow frequency relationships at ungaged locations based on all the available information. This method essentially compares the flood flow frequency results of various procedures and adopts a function which may constitute the results of one procedure or may be a constructed function which in its entirety is none of those analytically or otherwise determined. The emphasis was placed on the need of the professional performing the analysis to understand available procedures, study considerations which affect the analysis and utilization of field reconnaissance information, all of which influence the evaluation process and subsequent reliability of the results. An appendix was included which described in detail selected categories of procedures commonly used in analysis of flood flow frequency relationships for ungaged locations. The appendix included descriptions of the methodologies involved in using the individual procedures and listed the primary advantages and limitations of each. The use of the adopted frequency curve concept provides insight as to the variability and reliability of the results, places proper emphasis on the end product, the frequency curve, and generally results in better flood flow frequency estimates. (Humphreys-ISWS)
W80-05928

INTRODUCTION AND APPLICATION OF KINEMATIC WAVE ROUTING TECHNIQUES USING HEC-1,
Hydrologic Engineering Center, Davis, CA.
J. J. DeVries, and R. C. MacArthur.
Training Document No 10, May 1979. 98 p, 19 Fig, 5 Tab, 27 Ref, 2 Append.

Descriptors: *Flood routing, *Urban runoff, *Model studies, *Urban hydrology, Analytical techniques, Theoretical analysis, Mathematical models, Equations, Hydrograph analysis, Computer models, Systems analysis, Training, Discharge(Water), Overland flow, Flow, Methodology, Unsteady flow, Watersheds(Basins), Open channel flow, Storm drains, Routing, Urban drainage, *Kinematic wave routing, HEC-1, Gutter flow, Subbasins.

This document discussed the application of the kinematic wave routing method in HEC-1 for analyzing urban runoff processes. The physical processes of the urban runoff and streamflow routing were discussed briefly and related to the kinematic wave capabilities in the HEC-1 Flood Hydrograph Package. Data requirements along with specific methods of applying kinematic wave routing techniques to runoff problems in urban hydrology and example applications of the method to analyze typical problems were discussed. Chapter 1 presented introductory material necessary for an understanding of the theory, assumptions, equations, and numberical methods incorporated into HEC-1 for kinematic wave flood routing. Chapter 2 explained methods of applying kinematic wave routing techniques using HEC-1. An example problem was presented to illustrate HEC-1 input and output data, and effects of changes to numerical values of the parameters were discussed. Results of a 'hand' calculation were given in an Appendix to illustrate the basic solution procedure. (Humphreys-ISWS)
W80-05929

AQUEOUS-AND SEDIMENT-PHASE NITROGEN YIELDS FROM FIVE SOUTHERN PINE WATERSHEDS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W80-05939

LOW FLOW AND STORMWATER QUALITY IN URBAN CHANNELS,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5A.
W80-05943

STORMWATER DETENTION IN DEVELOPING WATERSHEDS,
Espey-Huston and Associates, Inc., Houston, TX.
C. B. Amandes, and P. B. Bedient.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE2, Proceedings Paper 15335, p 403419, April 1980. 8 Fig, 4 Tab, 17 Ref, 1 Append.

Descriptors: *Detention reservoirs, *Effects, *Sediments, *Pollutants, *Model studies, Mathematical models, Drainage, Storage, Storage tanks, Storm runoff, Urban runoss, Watersheds(Basins), Water management(Applied), Suspended solids, Phosphorus, Nitrogen, Water quality, Hydrology, *Houston(TX), Developing watersheds.

A method for evaluating the effects of subdivision scale detention storage basins on watershed hydrologic and water quality response was identified and applied to a developing watershed in Houston, Texas. Data used in the modeling efforts were obtained from historic flow records and mesured storm pollutant concentrations. Reductions in peak flows and sediment export provided by various sizes of detention basins were analyzed by the model STOREME for 200-acre (80-ha) developed areas. The results indicated that storage volumes on the order of 30-60% of the runoff volumes can reduce flood peaks to predevelop levels. Sedimnet removal efficiencies in the basins are between 90% and 100%. Analysis of various levels of storage controls on different frequency storms suggests that an optimum control level exists. The results were extended to define the overall watershed response for different land uses in Keegans Bayou. (Sims-ISWS)
W80-05944

LOG PEARSON TYPE 3 DISTRIBUTION: A GENERALIZED EVALUATION,
Saint Johns River Water Management District, Palatka, FL.
D. V. Rao.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Proceeedings Paper 15391, p 853-872, May 1980. 8 Fig, 5 Tab, 4 Ref, 2 Append.

Descriptors: *Flood frequency, *Probability, *Distribution patterns, Flow, Streamflow, Low flow, Floods, Frequency, Statistical methods, Hydrology, Log Pearson distributions, Probability theory, Probability distributions, Proability density functions.

A generalized study of log Pearson type 3 distribtuion (LP) was perfomed in terms of the dimensionless variate which has a population mean of unity. The bounds of LP and different forms assumed by it were presented on the basis of the variance and skewness coefficient. It was seen that as LP deviates more and more from the two parameter log-normal distribution, its upper bound becomes small, the lower bound becomes large, and its form disintegrates to J, reverse J or U shape, some of which are hydrologically unreasonable. The K values for different return periods indicate that a bias in skew estimate does not affect the quantities of LP in the same manner for all ranges and for all return periods. (Sims-ISWS)
W80-05949

HYDROGRAPHS BY SINGLE LINEAR RESERVOIR MODEL,
Army Engineer District, Los Angeles, CA.
J. T. Pedersen, J. C. Peters, and O. J. Helweg.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Proceedings Paper 15430,1 p 837-852, May 1980. 10 Fig, 4 Tab, 18 Ref, 2 Append.

Descriptors: *Hydrographs, *Rainfall-runoff relationships, *Model studies, Mathematical models, Runoff, Urban runoff, Watersheds(Basins), Cities, Unit hydrographs, Discharge(Water), Drainage, Storage, Water storage, Hydrology, Hydraulic similitude.

A single linear reservoir (SLR) model was presented that provided a simple means for developing runoff hydrographs for small, urbn watersheds. The model only requires one parameter, K, which can be estimated from watershed and precipitation characteristics. Several methods for estimating K and the results of testing the model on various watersheds were presented. (Sims-ISWS)
W80-05950

WINTERTIME FLOW DISTRIBUTION IN RIVER CHANNELS,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
H. T. Shen, and N. L. Ackermann.
Journal of the Hydraulics Division, American Socity of Civil Engineers, Vol 106, No HY5, Proceedings Paper 15427, p 805-817, May 1980. 8 Fig, 1 Tab, 17 Ref, 2 Append.

Descriptors: *Rivers, *Ice cover, *Flow *Distribution patterns, *Model studies, Mathematical models, Streamflow, Channels, Channel flow, Open channel flow, Ice, Winter, Discharge(Water), Hydraulics, Simulation analysis.

Analytical formulas were derived for predicting the transverse flow distribution in river channels based on the cross-sectional geometry and roughness coefficients. Both free surface flows and ice-covered flows were considered. Field data were used to validate the analysis. Applications of this analysis to hydraulic and transport processes in rivers were discussed. (Sims-ISWS)
W80-05951

CHARACTERISTICS OF LOW FLOWS,
American Society of Civil Engineers, New York. Hydraulics Div.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Proceedings Paper 15400, p 717-731, May 1980. 3 Fig, 1 Tab, 39 Ref, 1 Append.

Descriptors: *Low flow *Streamflow, *Florida, Hydraulics, Basins, Analysis, Water quality, Reach(Streams), Degradation(Stream), Analytical techniqlues, Surface waters, *Low flow evaluation, *Surface water hydrology, *Ochlockonee River, Meteorological factors, Geologic factors, Basin factors, Low flow forecasting.

A Task Committee of the Surface Water Hydrology Committee was organized in 1976 to determine the types of low-flow information needed, to describe available methods of characterizing low flows, and to identify needed analysees and data collection. Responses to a Task Committee survey of users of low-flow information indicated the need for better estimates of flow-flow characteristics at ungaged sites. Available analytical methods were described and evaluated, sources of low-flow information were given, and some recently proposed techniques were reported. Low-flow data on many addiional streams were needed. (Roberts-ISWS)
W80-05954

STORMWATER DRAINAGE IN URBAN AREAS,
National Building Research Inst., Pretoria (South Africa).
L. C. Miles.
Municipal Engineer (Johannesburg), Vol 10, No 2, p 25-26, 28-30, 32-35, 1979. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Stormwater, *Urban drainage, *Urbanization, *Runoff, *Drainage systems, *Peak discharge, Infiltration, Hydrology, Attenuation, Water storage, Roads, Climates, Channels, Vegetation effects, City planning.

Current practices and problems in urban storm water drainage are discussed. Urban hydrology is very complex and is dependent on infiltration, rate and volume of runoff, pollution, climate, and erosion. Infiltration of water into the soil is the most important of these and it will affect surface, subsurface, and ground water runoff. The high rate and volume of runoff creates high flood peaks even after moderate-sized storms. It is not economically feasible using current drainage practices to completely control such problems, especially in suburban areas. The main purposes of a drainage system are: (1) control of runoff to minimize loss of life and property caused by infrequent storms; (2) prevent disruption of the community by frequent storms; and (3) reduce erosion, pollution, and loss of runoff. A drainage system consisting of two cooperative systems, a minor system to control frequent storms (culverts, underground pipework) and a major system to control infrequent storms (storage areas, open drainage canals, flood plains, streets), provides the best solution. The type of minor system in an urban development should be decided by balancing the cost against the inconvenience to the community. Fifty years should be the minimum return period of the design storm. Regional drainage problems should be addressed by all concerned parties within the total drainage region. (Sidney-IPA)
W80-05994

2F. Groundwater

DOCUMENTATION OF A FINITE-ELEMENT TWO-LAYER MODEL FOR SIMULATION OF GROUND-WATER FLOW,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. J. Mallory.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-140932, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-18, August 1979. 347 p, 2 Fig, 6 Ref.

Descriptors: *Finite element analysis, *Model studies, *Mathematical models, *Groundwater movement, *Base flow, Aquifer characteristics, Groundwater recharge, Transmissivity, Storage coefficient, Numerical analysis, Equations, Computer programs, California, *FORTRAN IV, *Galerkin finite-element method.

This report documents a finite-element model for simulation of ground-water flow in a two-aquifer system where the two aquifers are coupled by a leakage term that represents flow through a confining layer separating the two aquifers. The model was developed by Timothy J. Durbin (U.S. Geological Survey) for use in ground-water investigations in southern California. The documentation assumes that the reader is familiar with the physics of ground-water flow, numerical methods of solving partial-differential equations, and the FORTRAN IV computer language. It was prepared as part of the investigations made by the U.S. Geological Survey in cooperation with the San Bernardino Valley Municipal Water District. (Kosco-USGS)
W80-05702

GEOCHEMICAL SIGNIFICANCE OF GROUNDWATER DISCHARGE AND CARBONATE SOLUTION TO THE FORMATION OF CALETA XEL HA, QUINTANA ROO, MEXICO,
Geological Survey, Reston, VA. Water Resources Div.
W. Back, B. B. Hanshaw, T. E. Pyle, L. N. Plummer, and A. E. Weidie.
Water Resources Research, Vol 15, No 6, p 1521-1535, December 1979. 12 Fig, 3 Tab, 20 Ref.

Descriptors: *Geochemistry, *Groundwater, *Discharge(Water), *Mexico, *Groundwater availability, Carbonates, Hydrogeology, Limestones, Water chemistry, Sampling, Groundwater movement, Freshwater, Saline water, Encroachment, Mineralogy, Equilibrium, Calcite, Brackish water, Mass transfer, *Xel Ha, *Quintana Roo(Mexico).

Xel Ha, Quintana Roo, Mex., is a lagoon whose location and morphology are partly controlled by the fracture pattern in upper Pleistocene coral-reef limestone. Chemical, isotopic, and hydrologic observations were made nearby where ground water could be sampled. Additionally, vertical profiles of similar observations were made at stations within the lagoon. Regionally, a thin lens of rapidly moving fresh ground water overlies a thick body of nearly stagnant saline ground water that is close to ocean water in chemical composition. These two chemically distinct ground waters are separated by a thin zone of diffusion and both are at or slightly beyond saturation with respect to calcite. When these two end-member ground waters mix to form the brackish dispersion zone, the resulting solution is undersaturated with respect to calcite. This was confirmed by mass transfer and isotopic modeling which show that the mixing of two solutions of different ionic strength, and each saturated with respect to calcite, results in an undersaturated solution. Model calculations indicate that as much as 1.23 millimoles of calcium carbonate may be dissolved per kilogram of water. We hypothesize that many of the cuspate beaches along the east coast of the Yucatan formed in this manner and that mixing of waters of different chemistry may be an important geomorphic process in certain geologic-hydrologic settings. (Kosco-USGS)
W80-05704

THE GEOCHEMISTRY OF THE FOX HILLS-BASAL HELL CREEK AQUIFER IN SOUTHWESTERN NORTH DAKOTA AND NORTHWESTERN SOUTH DAKOTA,
Geological Survey, Reston, VA. Water Resources Div.
D. C. Thorstenson, D. W. Fisher, and M. G. Croft.
Water Resources Research, Vol 15, No 6, p 1479-1498, December 1979. 9 Fig, 5 Tab, 68 Ref.

Descriptors: *Geochemistry, *Groundwater, *Aquifers, *North Dakota, *South Dakota, Alkalinity, Gases, Cation exchange, Groundwater movement, Groundwater recharge, Water quality, Water chemistry, Computer models, Carbon radioisotopes, Potentiometric level, Equilibrium, Ion exchange, *Southwestern North Dakota, Northwestern South Dakota, *Fox Hills Formation, *Hell Creek Formation.

The Upper Cretaceous Fox Hills Formation and the basal part of the overlying Hell Creek Formation constitute an important aquifer in the Fort Union coal region. Throughout most of southwestern North Dakota and northwestern South Dakota the aquifer is at depths ranging from 1,000 to 2,000 feet, except for exposures along the Cedar Creek anticline. Water flows in the aquifer from southwest to northeast, with flow rates of a few feet per year. The recharge and discharge areas of the aquifer are separated by a north-south trending transition zone in which significant changes in water chemistry occur. Computer modeling and carbon isotope data suggest the following reactions in the recharge area. Carbon dioxide derived from lignitic carbon reacts to dissolve carbonate minerals, with cations then being exchanged for sodium on clay minerals. The high pH in the aquifer is the result of buffering by carbonate-ion exchange equilibria. These changes can be accounted for by reactions in the aquifer: (1) Sulfate is reduced by lignitic carbon with formation of pyrite; (2) Hydrogen-ion concentration is continuously buffered by the carbonate-ion exchange equilibria. Chemical and hydrologic data suggest that the increase in sodium chlorine results from upward movement of small volumes of water into the Fox Hills aquifer from the transition zone eastward. Redox reactions in the aquifer are closely analogous to those observed in pore waters of reducing marine sediments. Reactions approach, but not achieve, true thermodynamic equilibrium. Measurements of redox potential suggest a down-gradient decrease in redox potential. The measurements are not amenable to quantitative interpretation. (Kosco-USGS)
W80-05705

BAROMETRIC FLUCTUATIONS IN WELLS TAPPING DEEP UNCONFINED AQUIFERS,
Geological Survey, Lubbock, TX. Water Resources Div.
E. P. Weeks.
Water Resources Research, Vol 15, No 5, p 1167-1176, October 1979. 8 Fig, 20 Ref.

Descriptors: *Barometric efficiency, *Water level fluctuations, *Water wells, *Water table, *Atmospheric pressure, Zone of aeration, Groundwater, Aquifers, Analog models, Soil water movement, Infiltration, *Ogallala Formation.

Water levels in wells screened only below the water table in unconfined aquifers fluctuate in response to atmospheric pressure changes. These fluctuations occur because the materials composing the unsaturated zone resist air movement and have capacity to store air with a change in pressure. Consequently, the translation of any pressure change at land surface is slowed as it moves

through the unsaturated zone to the water table, but it reaches the water surface in the well instantaneously. Thus a pressure imbalance is created that results in a water-level fluctuation. Barometric effects on water levels in unconfined aquifers can be computed by solution of the differential equation governing the flow of gas in the unsaturated zone subject to the appropriate boundary conditions. Solutions to this equation for two sets of boundary conditions were applied to compute water-level response in a well tapping the Ogallala Formation near Lubbock, Texas from simultaneous microbarograph records. One set of computations, based on the step function unit response solution and convolution, resulted in a very good match between computed and measured water levels. A second set of computations, based on analysis of the amplitude rations of simultaneous cyclic microbarograph and water-level fluctuations, gave inconsistent results in terms of the unsaturated zone pneumatic properties but provided useful insights on the nature of unconfined-aquifer water-level fluctuations. (Kosco-USGS)
W80-05710

GROUND-WATER-QUALITY DATA FROM THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2K.
W80-05717

HYDROGEOLOGIC DATA FROM THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-05718

THE MASS BALANCE APPROACH: APPLICATION TO INTERPRETING THE CHEMICAL EVOLUTION OF HYDROLOGIC SYSTEMS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W80-05719

A SUMMARY OF MEASURED HYDRAULIC DATA FOR THE SERIES OF STEADY AND UNSTEADY FLOW EXPERIMENTS OVER PATTERNED ROUGHNESS,
Geological Survey, NSTL Station, MS. Water Resources Div.
D. L. Collins, and K. M. Flynn.
Available from OFSS Bx 25425, Fed. Ctr. Denver, CO., paper copy $184.25, microfiche $3.50. Geological Survey open-file report 79-1260 (basic data) Part I and II, August 1979. 1404 p, 3 Fig, 39 Tab, 1 Ref.

Descriptors: *Flood plains, *Open-channel flow, *Steady flow, *Unsteady flow, *Roughness(Hydraulic), Streambeds, Grassed waterways, Flow rates, Flow characteristics, Channel morphology, Elevation, Hydrographs, Hydrologic data, Analytical techniques, *Flood Plain Simulation Facility, *Bay St Louis(Miss).

This report summarizes and makes available to other investigators the measured hydraulic data collected during a series of experiments designed to study the effect of patterned bed roughness on steady and unsteady open-channel flow. The patterned effect of the roughness was obtained by clear-cut mowing of designated areas of an otherwise fairly dense coverage of coastal Bermuda grass approximately 250 mm high. All experiments were conducted in the Flood Plain Simulation Facility during the period of October 7 through December 12, 1974. Data from 18 steady flow experiments and 10 unsteady flow experiments are summarized. Measured data included are ground-surface elevations, grass heights and densities, water-surface elevations and point velocities for all experiments. Additional tables of water-surface elevations and measured point velocities are included for the clear-cut areas for most experiments. One complete set of average water-surface elevations and one complete set of measured point velocities are tabulated for each steady flow experiment. Time series data, on a 2-minute time interval, are tabulated for both water-surface elevations and point velocities for each unsteady flow experiment. All data collected, including individual records of water-surface elevations for the steady flow experiments, have been stored on computer disk storage and can be retrieved using the computer programs listed in the attachment to this report. (Kosco-USGS)
W80-05722

GENERAL CONSERVATION EQUATIONS FOR MULTI-PHASE SYSTEMS: 3. CONSTITUTIVE THEORY FOR POROUS MEDIA FLOW,
Princeton Univ., NJ. Dept. of Civil Engineering.
M. Hassanizadeh, and W. G. Gray.
Advances in Water Resources, Vol 3, No 1, p 25-40, March 1980. 29 Ref, 3 Append.

Descriptors: *Mathematical models, *Equations, *Porous media, *Groundwater movement, Flow, Darcys law, Theoretical analysis, Momentum equation, Entropy, Energy equation, Thermodynamics, Multi-phase flow, Kinematics.

Equations that describe single phase fluid flow and transport through an elastic porous media were obtained by applying constitutive theory to a set of general multiphase mass, momentum, energy, and entropy equations. Linearization of these equations yielded a set of equations solvable upon specification of the material coefficients that arise. Further restriction of the flow to small velocities proved that Darcy's law is a special case of the general momentum balance. (Visocky-ISWS)
W80-05739

THE 'CHEAT SHEET': A NEW TOOL FOR THE FIELD EVALUATION OF WELLS BY STEP-TESTING,
Anderson and Kelly, Boise, ID.
J. E. Kelly, K. E. Anderson, and W. L. Burnham.
Ground Water, Vol 18, No 3, p 294-298, May-June 1980. 5 Fig, 23 Ref.

Descriptors: *Aquifer testing, *Pump testing, *Data processing, *Analytical techniques, Drawdown, Specific capacity, Transmissivity, Flow, Water yield, Discharge(Water), Groundwater, Aquifers, Pipe flow, Hydraulics, Turbulent flow, Laminar flow, Wells, Water wells, Hydrology.

Step-testing of wells penetrating a jointed, fractured, sometimes cavernous limestone-dolomite artesian aquifer showed characteristic patterns of extreme variation in specific capacity at different discharge rates. The application of principles developed by Jacob for well-loss determinations, and subsequent modifications by others, did not yield meaningful results. It was found that a log-log relationship between discharge and drawdown, through a large number of steps, could be used to evaluate the degree of nonlinear head losses in and near the well bore and make possible the extrapolation of drawdowns at higher discharge rates. This technique also has been used to estimate transmissivity which, in at least one instance, was confirmed by the subsequent evaluation of observation-well data by both straight-line and type-curve methods. The easy use and rapid initial evaluation of test data afforded by this method gave rise to the name 'Cheat Sheet.' (Sims-ISWS)
W80-05741

A NOTE ON POSSIBLE USE OF MICROCOMPUTERS FOR AQUIFER STUDIES,
J. K. Risner.
Ground Water, Vol 18, No 3, p 291-293, May-June 1980. 2 Fig, 4 Ref.

Descriptors: *Computers, *Computer programs, *Groundwater, *On-site investigations, Mathematical models, Equations, Theis equation, Aquifers, Aquifer testing, Data processing, Hydrology, *Microcomputers, Finite difference models.

Microcomputers can be a major tool for the hydrologist. Small and portable, microcomputers can be useful for the acquisition and modeling of an aquifer while on site. This would result in very low cost for computer usage and fast processing time. Their low cost makes the availability almost universal. Tests were run on the TRS-80 system using the Prickett finite difference model and the Theis equation. The results indicate that with the exception of memory storage no problems should arise. With newer generations of microcomputers core memory storage will no longer be a problem. (Sims-ISWS)
W80-05742

GROUND-WATER MANAGEMENT IN THE HIGH PLAINS,
Oklahoma Water Resources Board, Oklahoma City, Planning Div.
For primary bibliographic entry see Field 4B.
W80-05743

ESTIMATING TRANSMISSIVITY AND WELL LOSS CONSTANT USING MULTIRATE TEST DATA FROM A PUMPED WELL,
Geological Survey of Victoria (Australia).
G. Y. Nahm.
Ground Water, Vol 18, No 3, p 281-285, May-June 1980. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Aquifers, *Pumping, *Model studies, *Estimating equations, Mathematical models, Transmissivity, Drawdown, Storage, Groundwater, Pump testing, Discharge(Water), Hydrology, Well loss constant.

Since the introduction of the Theis equation in 1935, many attempts have been made to estimate aquifer parameters from pumping test data obtained from discharge wells. This practice has been criticized by most groundwater hydrologists because commonly the well loss factor is not dealt with in an acceptable manner. This paper presented a method of estimating transmissivity and well loss constant with due consideration for the well loss factor by using a programmable calculator to obtain regression constants of a best-fit curve to the data obtained from a number of short tests at different pumping rates. A set of simultaneous equations was derived from which the transmissivity and well loss constant can be calculated. (Sims-ISWS)
W80-05744

WELL-WATER QUALITY CHANGES CORRELATED WITH WELL PUMPING TIME AND AQUIFER PARAMETERS--FRESNO, CALIFORNIA,
Science and Education Administration, Fresno, CA. Water Management Research.
For primary bibliographic entry see Field 5A.
W80-05745

METHODOLOGY FOR MONITORING GROUND WATER AT URANIUM SOLUTION MINES,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W80-05746

DETERMINATION OF THE LOCATION AND CONNECTIVITY OF FRACTURES IN METAMORPHIC ROCK WITH IN-HOLE TRACERS,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
I. W. Marine.
Ground Water, Vol 18, No 3, p 252-261, May-June 1980. 12 Fig, 1 Tab, 4 Ref. DOE AT(07-2)-1.

Descriptors: *Hydrogeology, *Boreholes, *Borehole geophysics, *South Carolina, Fractures(Geologic), Groundwater, Groundwater movement, Tracers, Rocks, Geology, Drilling, Drillers logs, Hydraulic conductivity, Pumping, Path of pollutants, Hydrology.

In-hole tracer tests were used in a geohydrologic investigation of metamorphic rock at the Savannah River Plant near Aiken, South Carolina, to locate water-transmitting fractures and to determine the

connectivity of these fractures between boreholes. Only after development of a conceptual model of the fracture occurrence and connection could the proper methods of analysis for the hydraulic parameters be selected. In-hole tracers were used to locate fractures in a borehole and supplemented other methods, such as core inspection, geophysical logs, borehole wall imaging techniques, dry drilling, and packer tests. The first three of these do not necessarily investigate fluid-transmitting fractures. In the study of the connectivity of fractures between boreholes, the in-hole tracer techniques supplemented determinations by the rapidity of hydraulic response and the use of between-well tracer tests. In hydraulically transmissive rock, fractures were located by changes in the velocity of the tracer pulse in response to adding fluid to the well. In virtually impermeable rock, the movement of the tracer pulse in the rock was normalized to the movement of another tracer pulse in the cased portion of the well because the movement was so slow that direct measurement was difficult. Connectivity of fractures between boreholes was determined by placing an in-hole tracer in one hole and measuring the movement induced by pumping a nearby borehole. From this test, it was determined that the fractures were interlacing, and single fractures did not extend from one borehole directly to the other. (Sims-ISWS)
W80-05747

DISTRIBUTION AND PROBABLE SOURCE OF NITRATE IN GROUND WATER OF PARADISE VALLEY, ARIZONA,
Oklahoma Univ., Norman. School of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W80-05748

TRACE-ORGANICS BIODEGRADATION IN AQUIFER RECHARGE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-05749

SOLUTION OF THE TRANSPORT EQUATIONS USING A MOVING COORDINATE SYSTEM,
Washington Univ., Seattle. Dept. of Chemical Engineering.
O. K. Jensen, and B. A. Finlayson.
Advances in Water Resources, Vol 3, No 1, p 9-18, March 1980. 7 Fig, 4 Tab, 27 Ref.

Descriptors: *Mathematical models, *Groundwater movement, *Mass transport, *Convection, *Diffusion, Finite element analysis, Equations, Porous media, Numerical analysis, Boundaries(Surfaces), Moving coordinate system, Variable grid size, Finite-difference analysis.

A convection-diffusion equation arises from the conservation equations in miscible and immiscible flooding, thermal recovery, and water movement through desiccated soil. When the convection term dominates the diffusion term, the equations are very difficult to solve numerically. Owing to the hyperbolic character assumed for dominating convection, inaccurate oscillating solutions result. A new solution technique minimizes the oscillations. The differential equation is transformed into a moving coordinate system which eliminates the convection term but makes the boundary location change in time. The authors illustrated the new method on two one-dimensional problems: the linear convection-diffusion equation and a nonlinear diffusion type equation governing water movement through desiccated soil. Transforming the linear convection diffusion equation into a moving coordinate system gives a diffusion equation with time dependent boundary conditions. The authors applied orthogonal collocation on finite elements with a Crank-Nicholson time discretization. Comparisons were made to schemes using fixed coordinate systems. The equation describing movement of water in dry soil is a highly nonlinear diffusion-type equation with coefficients varying over six orders of magnitude. The authors solved the equation in a coordinate system moving with a time-dependent velocity, which is determined by the location of the largest gradient of the solution. The finite difference technique with a variable grid size was applied, and a modified Crank-Nicholson technique was used for the temporal discretization. Comparisons were made to an exact solution obtained by similarity transformation and with an ordinary finite difference scheme on a fixed coordinate system. (Visocky-ISWS)
W80-05767

PRELIMINARY ASSESSMENT OF DIFFERENT METHODS FOR BEDROCK WATER WELL LOCATION AND EVALUATION,
Vermont Univ., Burlington. Dept. of Geology.
For primary bibliographic entry see Field 7B.
W80-05792

GROUNDWATER SEEPAGE INTO GREAT SOUTH BAY, NEW YORK,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2L.
W80-05815

FLOW OF DILUTE POLYMERS THROUGH POROUS MEDIA,
Karlsruhe Univ. (Germany, F.R.).
F. Kaser, and R. J. Keller.
Journal of the Engineering Mechanics Division, American Society of Civil Engineers, Vol 106, No EM3, Proceedings Paper 15493, p 525-541, June 1980. 14 Fig, 1 Tab, 11 Ref, 2 Append.

Descriptors: *Porous media, *Flow, *Polymers, *Viscosity, Pressure, Degradation(Decomposition), Laboratory tests, Resistance, Saturation, Reynolds number, Newtonian fluids, Viscoelastic effects.

The flow of dilute polymer solutions throgh porous media was investigated experimentally. Large increases in flow resistance were noted, considerably higher than would be expected from Newtonian theory. This phenomenon was examined in terms of the viscoelastic properties of the polmer solutions. It was shown that the pressure gradient decreases along the porous medium due to degradation of the polymer. The degradation was shown to increase with increased strain rate. The onset of viscoelastic effects and the maximum increase in resistance were examined in terms of a previously developed model and were shown to be reasonably consistent. (Visocky-ISWS)
W80-05837

AVAILABILITY OF FRESH AND SLIGHTLY SALINE GROUND WATER IN THE BASINS OF WESTERNMOST TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
J. S. Gates, D. E. White, W. D. Stanley, and H. Ackermann.
Geological Survey open-file report 78-663, October 1978. 115 p, 27 Fig, 2 Tab, 49 Ref.

Descriptors: *Groundwater availability, *Freshwater, *Salinity, *Texas, Hydrologic data, Aquifers, Water level fluctuations, Test wells, Sampling, Chemical analysis, Water quality, Water storage, Groundwater recharge, Pumping, Drawdown, Water supply, Water yield, Water utilization, *Westernmost Texas, Saline water-freshwater interfaces.

Significant quantities of fresh ground water occur in the basin fill of the northern Hueco bolson and lower Mesilla Valley and in the Wildhorse Flat, Michigan Flat, Lobo Flat, and Ryan Flat areas of the Salt Basin; and may occur in Red Light Draw, Presidio bolson, and Green River valley. More than 20 million acre-feet of freshwater is estimated to be in storage in the basin fill of westernmost Texas. About 12 million acre-feet, or more than half, is in El Paso County in the Hueco bolson and Mesilla Valley. In addition, the basins contain about 7 million acre-feet of slightly saline water in basin fill, in Rio Grande alluvium in the Hueco bolson and lower Mesilla Valley, and in the Capitan Limestone in the northern Salt Basin. Groundwater pumping for municipal supply and industrial use in the El Paso area caused water-level declines of as much as 74 feet during 1903-73, and pumping for irrigation in the Salt Basin caused a maximum decline of 150 feet at Lobo Flat during 1949-73. Additional development of ground water in westernmost Texas will be accompanied by further declines in water levels, and will probably induce local migration of slightly saline or poorer quality water into freshwater areas. Land-surface subsidence could occur in local areas where water-level declines are large and the basin fill contains large amounts of compressible clay. (Kosco-USGS)
W80-05877

SIMULATED CHANGES IN WATER LEVEL IN THE PINEY POINT AQUIFER IN MARYLAND,
Geological Survey, Townson, MD. Water Resources Div.
J. F. Williams, III.
Maryland Geological Survey Report of Investigations No 31, 1979. 50 p, 21 Fig, 6 Plates, 7 Tab, 39 Ref.

Descriptors: *Model studies, *Water levels, Aquifers, *Maryland, *Groundwater, Computer models, Hydrogeology, Drawdown, Confined water, Leakage, Observation wells, Water level fluctuations, Hydrologic propertis, Aquifer characteristics, Potentiometric level, Forecasting, Water requirements, Withdrawal, Methodology, *Piney Point aquifer(MD), Two-dimensional simultion, Finite-difference methods.

A two-dimensional finite-difference computer model of the freshwater part (less than 250 milligrams per liter chloride) of the Piney Point aquifer in Maryland was developed to simulate and predict future drawdown in the aquifer. The aquifer was modeled as a confined aquifer recharged by leakage from an overlying aquifer, which is separated from the Piney Point by semiconfining material. Calibration was obtained by comparing computed versus measured water-level changes between the years 1952-76, 1970-74, 1974-75, and 1975-76. The aquifer characteristics determined to represent the Piney Point aquifer were: Transmissivity, less than 100 to 6,200 feet squared per day; and storage coefficient, 0.0003. The characteristics determined to represent the semiconfining material were: Vertical hydraulic conductivity, 1x10 to the minus 8th power to 1x10 to the minus 12th power feet per second; specific storage, .000006 per foot; and thickness, 50 to 305 feet. The model predicts future water-level changes in the aquifer between 1976-80, 1976-85, and 1976-90 when pumped under a variety of probable and hypothetical withdrawl arrangements. Predictions indicate that pumping rates based on the best estimates of future pumping will not cause serious additional declines in the potentiometric surface of the aquifer by 1990. Predictions also indicate that excessive drawdowns would not occur in most areas if all appropriated water was pumped in addition to estimated nonappropriated future pumping. Pumpage that would be required for proposed nuclear powerplants would seriously affect future water levels in those areas adjacent to the powerplants. (Kosco-USCG)
W80-05879

MAPS SHOWING GROUND-WATER CONDITIONS IN THE NORTHERN PART OF THE GILA RIVER DRAINAGE FROM PAINTED ROCK DAM TO TEXAS HILL AREA, MARICOPA, PIMA, AND YUMA COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-05882

MAPS SHOWING GROUND-WATER CONDITIONS IN THE GILA RIVER DRAINAGE FROM TEXAS HILL TO DOME AREA AND IN THE WESTERN MEXICAN DRAINAGE AREA, MARICOPA, PIMA, AND YUMA COUNTIES, ARIZONA--1977.

Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-05883

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--LOWER COLORADO REGION,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-05885

PHYSICAL CHARACTERISTICS OF SOME MINESOILS,
Pennsylvania State Univ., University Park. Dept. of Agronomy
For primary bibliographic entry see Field 3B.
W80-05955

GROUND-WATER POLLUTION BY SEPTIC TANK DRAINFIELDS,
Washington Univ., Seattle. Dept. of Environmental Health.
For primary bibliographic entry see Field 5A.
W80-05958

METHOD AND APPARATUS FOR TAPPING GROUNDWATER,
H. Bielaczek.
U.S. Patent No 4,176,716, 7 p, 5 Fig, 16 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 109, December 4, 1979.

Descriptors: *Patents, *Groundwater, *Water sources, Water wells, Shallow wells, Equipment, Pumps.

The invention is concerned with shallow wells, i.e., those deriving their water from water-bearing ground strata up to a depth of about ten meters, i.e., from essentially the upper water-bearing strata. The method comprises inserting a probe into the ground and taking soil samples until a water-bearing stratum has been located; thereupon sinking a riser tube into the soil to the water-bearing stratum, and inserting water-conveying means into the riser tube. The water-conveying means may comprise an element with a foot valve, such as a hose or conduit of metallic or non-metallic (e.g., rubber, synthetic plastic) material. It may also comprise suction means, such as a pump or the like. (Sinha - OEIS)
W80-05962

2G. Water In Soils

PARTICULAR SOLUTIONS TO THE PROBLEM OF HORIZONTAL FLOW OF WATER AND AIR THROUGH POROUS MEDIA NEAR A WATER TABLE,
Cold Regions Research and Engineering Lab., Hanover, NH.
Y. Nakano.
Advances in Water Resources, Vol 3, No 1, p 19-24, March 1980. 9 Ref.

Descriptors: *Mathematical models, *Soil water movement, *Water table aquifers, *Unsaturated flow, Groundwater movement, Equations, Theoretical analysis, Flow, Porous media, Water table, Darcys law, Air-water interfaces, Two-phase flow, Air-water mixture, Air flow.

Particular solutions to the problem of horizontal flow of water and air through porous media near a water table were derived, and regularity properties of the solutions were presented. It was found that a singularity occurs in the solutions at the water table, and the water table can be interpreted as an acceleration wave of the nth order in terms of either air or water flow where n is a positive integer. Effects of air flow on water flow were discussed. (Visocky-ISWS)
W80-05734

SOLUTION OF THE TRANSPORT EQUATIONS USING A MOVING COORDINATE SYSTEM,
Washington Univ., Seattle. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 2F.
W80-05767

THERMOGRAPHY FOR ESTIMATING NEAR-SURFACE SOIL MOISTURE UNDER DEVELOPING CROP CANOPIES,
South Dakota State Univ., Brookings, Remote Sensing Inst.
For primary bibliographic entry see Field 7B.
W80-05768

PERMEABLE BACKFILL EFFECTS ON WATER REMOVAL BY SUBSURFACE DRAINS IN CLAY SOIL,
Ohio State Univ., Columbus. Dept. of Agronomy.
G. S. Taylor, S. S. Hundal, and N. R. Fausey.
Transactions of the American Society of Agricultural Engineers, Vol 23, No 1, p 104-108, January-February 1980. 5 Fig, 15 Ref.

Descriptors: *Subsurface drains, *Backfill, *Permeability, Drainage, Tile drainage, Subsurface drainage, Soils, Soil types, Clays, Silts, On-site investigations, Irrigation, Soil water, Soil moisture, Soil science, Agricultural engineering, Permeable backfill.

A highly permeable backfill was created by trenching and backfilling directly over drains installed 6 yr earlier in a lakebed clay soil. The backfill increased drain flow rates by a factor of two to four during periods of ponding but had no effect on flow rates after ponding ceased. The full potential of the backfill could not be determined because of the limited hydraulic capacity of the drains. The backfill had no effect on water table drawdown, apparently because of excellent surface drainage that diverted ponded water from untrenched drains to adjacent trenched ones. After one year, flow rates remained the same where the permeable backfill extended to within 5 cm of the drain but were reduced 20-25% where the backfill extended to the drain. (Sims-ISWS)
W80-05820

STOCHASTIC MODEL OF FLOW THROUGH STRATFIED SOILS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
E. M. Ali, T. H. Wu, and N. Y. Chang.
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol 106, No GT6, Proceedings Paper 15487, p 593-610, June 1980. 15 Fig, 19 Ref, 1 Append. NSF ENG76-20852.

Descriptors: *Soils, *Statistical methods, *Markov processes, *Stochastic processes, *Permeability, *Varves, Soil physical properties, Model studies, Probability, Seepage, Clays, Flow, Soil water movement, Stratified soils.

The flow through stratified soils was analyzed using probability theory. The stratification was represented by a stochastic model composed of two Markov chains. Studies were made on two varved clays and a glacial outwash deposit. Seepage in stratified soils was analyzed by a random flow model. The stochastic model for soil stratification was incorporated in the flow model. Simulation techniques were used to obtain the statistical properties of the permeability of the varved clay and outwash deposits. The mean, variance, and autocorrelation functions of permeability were computed and compared with experimental results from a varved clay. (Visocky-ISWS)
W80-05838

RAPID DETERMINATION OF SOIL WATER CHARACTERISTIC BY THERMOCOUPLE PSYCHROMETRY,
Soil Conservation Service, Price, UT.
F. R. Riggle, and D. C. Slack.
Transactions of the Amrican society of Agricultural Engineers, Vol 23, No 1, p 99-103, January-February 1980. 5 Fig, 3 Tab, 27 Ref.

Descriptors: *Soil water, *Soil moisture, *Measurement, *Analytical techniques, Laboratory tests, Hygrometry, Equipment, Temperature, Soil temperature, Pressure, Soil pressure, Soils, Soil tests, Soil properties, Soil science, Thermocouple psychrometry.

A procedure was developed for determination of the soil water characteristic curve with thermocouple psychrometry. Complete soil water characteristic curves were obtained for a Nicollet clay loam, a Waukegan silt loam, and a Hubbard sand within one week in ambient air conditions. The curves obtained by the psychrometer method compared favorably with those obtained by pressure methods. (Sims-ISWS)
W80-05871

THE EFFECT OF PROFILE MODIFICATION OF A FRAGIUDALF ON WATER EXTRACTION AND GROWTH BY GRAIN SORGHUM,
Science and Education Administration, Lafayette, IN.; and Purdue Univ., Lafayette, IN. Dept. of Agronomy.
J. M. Bradford, and R. W. Blanchar.
Soil Science Society of American Journal, Vol 44, No 2, p 374-378, March-April 1980. 3 Fig, 4 Tab, 5 Ref.

Descriptors: *Soils, *Soil profiles, *Soil water, *Crops, Grain sorghum, Soil treatment, Mixing, Permeability, Soil movement, Sawdust, Limes, Subsoil, ON-site investigations, Soil science, Agriculture, Fragipan soils.

The dense and slowly permeable layer in fragipan soils restricts the downward movement of water and plant roots. Thoroughly mixing a Hobson soil profile (Typic Fragiudalfs) and incorporating lime and sawdust into the profile increased sorghum grain yields and water storage. Over a 3-year period, sorghum grain yields were increased by 50% due to the mixing process alone and by 150% when lime and sawdust were added prior to mixing. The water storage in the early growing season was greater in sawdust-incorporated modified soil plots, and greater amounts of water were utilized by the plants during the growing season. The natural fragipan profile contained the greatest amount of water in late summer, but water in or below the fragipan was not accessible to the plant because of restriction on rooting. (Sims-ISWS)
W80-05940

ALFALFA FOR HYDROLOGIC CONTROL OF SALINE SEEPS,
Science and Education Administration, Sidney, MT.
A. D. Halvorson, and C. A. Reule.
Soil Science Society of America Journal, Vol 44, No 2, p 370-374, March-April 1980. 7 Fig, 2 Tab, 10 Ref.

Descriptors: *Saline soils, *Alfalfa, *Soil water, Water management(Applied), Salts, Salinity, Vegetation effects, Water levels, Percolation, Infiltration, Soil water movement, Reharge, Precipitation(Atmospheric), Drainage, Crops, Soils, Hydrology, Saline seeps.

Saline seeps affect extensive dry cropland areas in the Northern Great Plains and methods need to be devised to control them. The effectiveness of alfalfa (Medicago sativa L.) in controlling saline seepage on northern Great Plains small grain dryland farms was studied from 1971 to 1977. Alfalfa, when grown on about 80% of the recharge area, reduced the deep percolation of soil water and provided hydrologic control for two seep areas within 1 year after its establishment in recharge areas. As the perched water table receded, the soil surface in the discharge (seepage) area dried allowing passage of farm implements, soil salinity decreased, and weeds, grasses, and crops grew better in the seepage area. In contrast, a buffer strip of alfalfa (occupying about 20% of recharge area) on the upslope side of a saline seep did not provide hydrologic control. Greenhouse data indicated

that a alfalfa yields will decrease rapidly if soil salinity increases to high levels above a saline water table. Reduced plant growth resulted when salts accumulated in the root zone as water moved upward by capillary action. When in situ root zone salinity reached an EC of 38 mmho/cm, alfalfa growth essentially ceased. It was concluded that alfalfa can effectively control the hydrology of saline seep areas if it is grown on a major portion of the recharge area. (Sims-ISWS)
W80-05941

COMPARISON OF FIELD AND LABORATORY DETERMINED HYDRAULIC CONDUCTIVITY VALUES,
Auburn Univ., AL. Dept. of Soils.
J. H. Dane.
Soil Science Society of America Journal, Vol 44, No 2, p 228-231, March-April 1980. 5 Fig, 2 Tab, 15 Ref.

Descriptors: *Hydraulic conductivity, *On-site tests, *Laboratory tests, *Moisture content, *Pressure head, Soil properties, Soil profiles, Soil moisture, Cores, Irrigation, Bulk density, Unsaturated soil, Water retention curves.

Several new methods of determining hydraulic conductivity (K)-volumetric water content (theta) relations have been developed recently. Emphasis is on simplification of procedures that determine K(theta) relations in the field. This paper compares four different procedures by which K(theta) relations were determined for several horizons of a Troup loamy sand (Grossarenic Faleudults). The first procedure consisted of in situ measurement of water content and pressure head profiles following irrigation. All measurements were obtained with the soil surface covered to prevent evaporation. The data were used to calculate K(theta) values. The second procedure consisted of a model that used water retention curves and saturated K values determined on undisturbed core samples. The third method was a variation of the second in that water retention data were used as measured in situ. The fourth method used in situ measured water content data only. For the coarse textured soil used in this investigation the latter method was modified in that two empirical equations were needed instead of one to represent one K(theta) relation. All four methods resulted in K(theta) relations that were in fairly good agreement. (Visocky-ISWS)
W80-05956

SIMULTANEOUS TRANSPORT OF SURFACE-APPLIED SALTS AND WATER THROUGH UNSATURATED SOILS AS AFFECTED BY INFILTRATION, REDISTRIBUTION, AND EVAPORATION,
Isfahan Univ. (Iran). Inst. of Horticulture.
I. S. Dahiya, M. Singh, and S. Hajrasuliha.
Soil Science Society of America Journal, Vol 44, No 2, p 223-228, March-April 1980. 6 Fig, 1 Tab, 17 Ref.

Descriptors: *Leaching, *Salts, *Infiltration, *Evaporation, Soils, Soil types, Soil water, Soil moisture, Chlorides, Profiles, Soil profiles, Soil science, Soil water movement, Soil water redistribution.

A study, conducted in soil columns and involving three texturally different initially moist and dry soils, verified certain concepts regarding simultaneous transport of surface-applied salts and water under transient unsaturated flow conditions. Calcium chloride, spread on the soil surface, was leached with water under transient and steady infiltration conditions. Salt and water profiles were determined immediately following infiltration and after matching total infiltration, redistribution, and evaporation times. Chloride was leached more efficiently and to relatively deeper depths with lower than with higher rates of water application only in sandy and sandy loam soils. Appreciable chloride accumulation occurred during evaporation in surface layers of these soils in columns initially leached with continuous ponding of water. Irrespective of water application rates, nearly no upward movement of salts occurred in clay soil due to evaporation. In all cases, the displacement of salts by invading salt-free water did not show piston-like behavior as reported by some workers. In contrast to some earlier reports, the advance of the salt front was dependent on the initial soil water content. Upward movement of salts toward surface layers due to evaporation was greater in initially moist sandy loam and initially dry sandy soils. (Sims-ISWS)
W80-05957

2H. Lakes

PHYSIOCOCHEMICAL FACTORS AND THEIR EFFECTS ON ALGAL GROWTH IN A NEW SOUTHERN CALIFORNIA RESERVOIR,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5C.
W80-05720

WIND WAVES IN THE NARROWS OF A RESERVOIR,
M. I. Krivoshey, and Ye. M. Fedulova.
Soviet Hydrology: Selected Papers, Vol 16, No 4, p 326-329, 1977. 3 Fig, 1 Tab, 3 Ref. Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No 247, p 122-128, 1977.

Descriptors: *Waves(Water), *Reservoirs, *On-site investigations, Lakes, Analysis, Foreign research, Data collections, Height, Fetch, Winds, *USSR, Wind waves.

This analysis of wind waves in reservoir narrows was based on the station data and shipboard observations in the Klimovka and Sengiley narrows of the Kuybyshev Reservoir. The minimum width of the Klimovka narrows is 3.5 km, and of the Sengiley narrows, 7.5 km. The results of the studies can be formulated briefly in the following manner: (1) The height of wind waves in narrows differs from that in pools. The coefficient of variation of wave height in narrows depends on wind speed, the width of the narrows, and fetch. As a rule, it is less than unity. However, with very small fetches or with very high wind speeds this coefficient can be greater than unity. (2) Wind waves are virtually the same on the axis of the narrows and in the shore area for constant values of dimensionless fetch and dimensionless depth. An insignificant difference is observed at low wind speeds (W less than 7 m/sec). (3) The nature of formation of the wave field in the narrows during longitudinal and transverse winds is virtually identical. (4) The coefficient of variation of wave height at the exit from the narrows is the same as in the narrows, and at the entrance is less than in the narrows. (Humphreys-ISWS)
W80-05772

SYSTEMS OF WIND WAVES IN RESERVOIRS,
M. I. Krivoshey, and S. S. Strekalov.
Soviet Hydrology: Selected Papers, Vol 16, No 4, p 270-272, 1977. 2 Fig, 5 Ref, Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No 246, p 129-133, 1977.

Descriptors: *Reservoirs, *Waves(Water), *Model studies, Winds, Analytical techniques, Analysis, Mathematical models, On-site data collections, Lakes, Foreign research, Statistical methods, *USSR, Wind waves, Spectral analysis.

The term 'wave system' means wave motion having a single origin and a single-peak frequency energy spectrum. A subresonance system develops virtually always, while the formation of a resonance system requires certain conditions, i.e., sufficient depth, continuous wind, etc. An analysis of the main statistical characteristics of subresonance and resonance systems was given. It was shown that: (1) Two wave systems, subresonance and resonance, can develop in reservoirs 10-20 m deep at low wind velocities (to 7 m/sec). (2) The indeterminacy of the relation between dimensionless wave height and dimensionless fetch for large relative depths is due to the fact that two wave systems develop in reservoirs at low wind velocities (to 7 m/sec) and only one system, subresonance, at high velocities (10-20 m/sec). (Humphreys-ISWS)
W80-05774

DETERMINATION OF PARAMETERS FOR COMPUTING THERMAL POLLUTION ZONES IN HEATED BODIES OF WATER,
T. N. Filatova, M. R. Tsippert, I. A. Zair-Bek, M. N. Kumarina, and L. I. Minina.
Soviet Hydrology: Selected Papers, Vol 16, No 4, p 261-269, 1977. 6 Fig, 1 Tab, 7 Ref, Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No 246, p 97-112, 1977.

Descriptors: *Thermal pollution, *Model studies, *Reservoirs, *Heated water, Mathematical models, Water temperature, Forecasting, On-site investigations, Distribution, Spatial distribution, Analytical techniques, Analysis, Foreign research, Thermal powerplants, Currents(Water), *USSR.

The results presented related mainly to areas where the warm water of the Estonian and Baltic state regional electric power plants that is discharged into the Narva Reservoir spreads out. Thermal pollution zones were computed for areas measuring 0.3 x 2.5 km and 1.5 x 3.0 km, respectively. In both areas the thermal pollution zone did not exceed the limits of the reference areas. Analysis of the data obtained led to the following conclusions: (1) A deviation delta t of the computed temperatures from the measured temperatures by 3-4C was observed most often (especially in summer) at a distance of 200-250 m downstream of the mouth of the wasteway of the Estonian power plant. This can probably be attributed to the complex hydrodynamic conditions in this part of the reservoir. In the rest of the investigated area of the Estonian power plant the value of delta t does not exceed + or - 1.0C. The values of delta t are of the same order of magnitude most of the time in the area of the Baltic power plant. The highest values of delta t here are about + or - 2-4C and are recorded mainly in autumn. (2) There are no significant differences in the results of computations from mean monthly meteorological data and data reduced to the instant of measurement of the temperature field, as well as in the results of computations from the maximum temperature measured at a power plant and at the mouth of the wasteway. (3) In most cases, the results of computations agree well and satisfactorily with the results of aircraft measurements. (4) Some results of computations of the curves of the temperature drop do not agree satisfactorily with the results of observations and require additional investigation. (Humphreys-ISWS)
W80-05775

DISTRIBUTION OF NITROGENOUS COMPOUNDS IN A SMALL LAKE,
Gumma Inst. of Public Health, Maebashi (Japan).
M. Uchiyama, T. Yoshie, and T. Akuzawa.
Water Research, Vol 14, No 5, p 521-523, 1980. 4 Fig, 1 Tab, 8 Ref.

Descriptors: *Nitrogen compounds, *Lakes, *Water quality, Distribution, Nitrates, Nitrites, Ammonia, Amino acids, On-site investigations, Analysis, Data collections, Foreign research, *Japan.

The distribution and fate of nitrogenous compounds in Jyonuma Lake were investigated. This lake has a small surface area (about 0.5 sq km) but is long and relatively narrow and shallow (average water depth of about 1 m). The influent river flows through Tatebayashi City with a population of about 65,000. Green algae abound in this lake. Direct chemical measurement indicated that about 50-60% of ammonia nitrogen was converted to organic nitrogen, and a part of this sinks down while flowing through the lake. (Humphreys-ISWS)
W80-05780

NON-STEADY STATE BULK TEMPERATURE DETERMINATION FOR STABILIZATION PONDS,
Agency for International Development, Washington, DC.
J. J. Fritz, D. D. Meredith, and A. C. Middleton.

Water Research, Vol 14, No 5, p 413-420, 1980. 6 Fig, 2 Tab, 22 Ref.

Descriptors: *Oxidation lagoons, *Water temperature, *Heat balance, *Model studies, Mathematical models, Equations, Evaporation, Ponds, Waste water treatment, Analytical techniques, Analysis, Solar radiation, Lakes, Model verification.

This paper outlined a computational procedure to estimate pond bulk liquid temperature. This computational procedure is part of a dynamic biochemical model for wastewater stabilization ponds. The equation for computing mean pond temperature was derived from a heat and mass balance for a completely mixed pond. The resulting time-dependent differential equation was solved for a 4-h computational time step to compute the mean pond temperature. The 4-h values were used to compute daily and weekly values. Reported data for an existing stabilization pond located in New Mexico were used to evaluate the model's performance. Observed solar radiation, 24-h composite samples of pond liquid temperature, and daily values for flow rate, wind velocity, relative humidity, air temperature, and water temperature were reported for approximately 1 year at the site. Correlation with observed data was satisfactory. The model results were sufficient for the computation of stabilization pond performance using biokinetic expressions that were available on a seasonal basis. This model can be used for stabilization ponds and natural shallow lakes. The computational procedure is simple and can be used in conjunction with complex biochemical models to predict stabilization pond performance. (Humphreys-ISWS)
W80-05782

DEPOSITION OF DREDGED SEDIMENT AT OPEN WATER SITES,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2L.
W80-05787

FACTORS REGULATING INTRAZOOPLANKTON PREDATION BY POLYPHEMUS PEDICULUS,
New Hampshire Univ., Durham. Dept. of Zoology.
J. F. Haney, and M. T. Mattson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-200108, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Center, Univ. of NH. Research Report No 29, 1980. 154 p, 38 Fig, 19 Tab, 79 Ref, 1 Append. OWRT A-041-NH(2), 14-31-0001-5029.

Descriptors: *Microorganisms, *Predators, *Zooplankton, *Cladocera, *Computer models, *Copepods, Ponds, Mortality, Lakes, *Nauplii, *Polyphemus pediculus, *Chonochilus, Seasonal changes, Seasonal abundance, Reproductive modes, Biotic factors, Cyclopoids.

A stratified random sampling design was evaluated in its ability to quantify spatial and seasonal changes in the abundance of the predatory cladoceran, Polyphemus pediculus. Seasonal abundance was typified by an exponential rise to a spring maximum, followed by an exponential decline to a summer plateau, and a final decline to zero in late fall. Changes in seasonal abundance resulted primarily from variation in natality rates of the Polyphemus population associated with alternation between parthenogenetic and gamogenetic reproductive modes. In the spring and fall, the total Polyphemus population was primarily littoral, and in the summer it was also limnetic in distribution, although mean density was always greatest in the littoral. Diel changes in population distribution also occurred, and the population was aggregated at the lake surface in the day and dispersed horizontally and vertically in the epilimnion at night. Daytime patch location was highly correlated with wind direction, and patch configuration was dependent on the type of Polyphemus (sexual or asexual) present. A compartment model is proposed to explain the relationship between patch formation and biological and environmental factors. A deterministic computer model was used to estimate the predation impact of the Polyphemus population on nauplii and Chonochilus. Maximum spring mortality rates for these prey were 8-11%/day.
W80-05795

SPRING TRANSITION PERIOD IN LAKE ONTARIO--A NUMERICAL STUDY OF THE CAUSES OF THE LARGE BIOLOGICAL AND CHEMICAL GRADIENTS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
D. Scavia, and J. R. Bennett.
Canadian Journal of Fisheris and Aquatic Sciences, Vol 37, No 5, p 823-833, May 1980. 9 Fig, 3 Tab, 37 Ref.

Descriptors: *Lakes, *Lake Ontario, *chemicals, *Biological communities, *Model studies, Mathematical models, Physical properties, Water temperature, Circulation, Water circulation, Convection, Upwelling, Hydrodynamics, Ecological distribution, Ecology, Phytoplankton, Zooplankton, Detritus, Limnology.

A two-dimensinal model that calculates physical transport, as well as in situ biological and chemical transformations, accurately simulates observatins made along a north-south transect in Lake Ontario during April-June 1972. Simulation results show that, during the transition period between spring and summer, the inshore-offshore structure of biological and chemical distributions is controlled by the interaction of in situ processes and differences in vertical mixing on either side of the 4 C isotherm. Owing to reversals in flow patterns, the effect of advection is to reduce concentration gradients, but the effect on overal distributions is minimal. An analysis of sinking losses in one- and two-dimensional models indicate that the artificially low sinking rates used in one-dimensional models of the Great Lakes result from the neglect of upwelling. (Sims-ISWS)
W80-05814

FACTORS AFFECTING SALINITY REDUCTION IN LAKE TARPON, PINELLAS COUNTY, FLORIDA,
Southwest Florida Water Management District, Brooksville.
For primary bibliographic entry see Field 5B.
W80-05819

MODELING RESERVOIR SYSTEM WITH PUMPED STORAGE,
Army Engineer District, Savannah, GA.
G. F. McMahon, V. R. Bonner, and B. S. Eichert.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 106, No WR1, Proceedings Paper 15248, p 239-254, March 1980. 3 Fig, 4 Tab, 13 Ref, 2 Append.

Descriptors: *Reservoirs, *Reservoir operation, *Pumped storage, *Model studies, Mathematical models, Hydroelectric power, Dams, Storage, Water levels, Reservoir releases, Pumping, Simulation analysis, *Russell(Richard B) Dam(GA), *Savannah River(GA).

The Richard B. Russell Dam and Lake Project is presently under construction and is being placed in tandem between Hartwell and Clark Hill, two existing multipurpose hydropower plants on the Savannah River. System operational simulations were performed in support of a feasibility study for the installation of pump turbines at Russell, using a version of the Corps of Engineers HEC-5C computer program modified for system power and pumped storage. Information developed from the simulations include system hydropower production, pumping energy requirements, daily reservoir pool fluctuations, and reservoir elevation statistics. This information was useful in judging the effects of the addition of pumped storage on system hydropower production and reservoir recreation useability, as well as in ascertaining efficient system operational methods. (Sims-ISWS)
W80-05821

SHALLOW WATER SURFACE WAVE ELEVATION DISTRIBUTIONS,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2L.
W80-05824

BENTHIC AND ATMOSPHERIC CONTRIBUTIONS TO THE NUTRIENT BUDGETS OF A SOFT-WATER LAKE,
Connecticut Univ., Storrs. Dept. of Biological Sciences.
R. W. Kortmann.
Limnology and Oceanography Vol 25 No 2 p 229-239, 1980. 6 Fig, 6 Tab, 22 Ref. OWRT-A-071-CONN(3),14-31-0007-6007.

Descriptors: *Phosphorus, *Silica, Diurnal, Incubation, Atmosphere, *Nutrients, *Eutrophication, *Lakes, *Soft-water bog lake, *Benthic contribution, Dissolved nitrogen, Ferrous iron, Benthic flux, Sediment interstitial water sampling techniques.

Steady state, in situ incubation, and empirical phosphorus models were used to quantify the fluxes of nutrient and redox active materials in Dunham Pond. Benthic flux contributions were about 16 and 45% of the annual silica and ammonia budgets. Labile dissolved organic nitrogen is used by the lake system while refractory dissolved organic nitrogen is being produced. The phosphorus retention estimate based on aerial water loading predicted spring phosphorus concentration and loading more accurately than that based on the phosphorus budget. Atmospheric contributions of phosphorus and dissolved nitrogen account for 25 and 10% of the respective annual budgets.
W80-05833

MEASUREMENT OF WHOLE LAKE SEDIMENT ACCUMULATION AND PHOSPHORUS RETENTION USING LEAD-210 DATING,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 2J.
W80-05835

TWO-DIMENSIONAL HEATED JETS IN SHALLOW WATER,
Iowa Univ., Iowa City.
For primary bibliographic entry see Field 5B.
W80-05839

ACCURACY OF HARBECK DIAGRAM FOR FORCED EVAPORATION,
Espey, Huston and Associates, Inc., Austin, TX.
For primary bibliographic entry see Field 5B.
W80-05840

DENSITY CURRENTS IN SIDEARMS OF COOLING PONDS,
Iowa Univ., Iowa City, Inst. of Hydraulic Research.
For primary bibliographic entry see Field 5B.
W80-05841

PERFORMANCE OF POWER PLANT COOLING LAKES IN POLAND,
Institute of Meteorology and Water Management, Warsaw (Poland). Water Management Div.
For primary bibliographic entry see Field 5B.
W80-05842

HEAT LOSS FROM SIDEARMS OF COOLING LAKES,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
T. W. Sturm, and J. F. Kennedy.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Proceedings Paper 15398, p 783-804, May 1980. 10 Fig, 10 Ref, 3 Append.

Descriptors: *Heat balance, *Lakes, *Cooling, *Model studies, Heated water, Mathematical models, Heat transfer, Water temperature, Buoyancy, Analytical techniques, Profiles, Numerical analysis, Laboratory tests, Currents(Water), Density currents, Stratification.

Gravity currents arising from thermally induced buoyancy in sidearms of cooling lakes were analyzed with a numerical model that was based in part on experimental observations. The boundary layer forms of the momentum and thermal energy equations were solved by a variation of the Karman-Polhausen technique. The numerical model incorporates the coupling between the momentum and thermal energy equations that results from thermally induced buoyancy forces that diminish as cooling of the water surface occurs through natural heat transfer processes. The numerical model results for surface heat-loss rate from the sidearm, entrance discharge, and surface temperature drop along the sidearm were shown ultimately to depend on the Grashof number and modified Prandtl number, and the results were compared with experimental data. Application of the numerical results demonstrates the significant heat loss that can occur from a sidearm in a cooling lake. (Humphreys-ISWS)
W80-05844

THERMAL STRUCTURE OF COOLING PONDS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
G. H. Jirka, and M. Watanabe.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Proceedings Paper No 15412, p 701-715, May 1980. 9 Fig, 22 Ref, 2 Append.

Descriptors: *Cooling, *Lakes, *Stratified flow, *Model studies, Ponds, Heat transfer, Mixing, Stratification, Thermal stratification, Mathematical models, Analytical techniques, On-site tests, Laboratory tests, Hydraulic models, Water temperature, Analysis, Cooling systems, Heat dissipation, Deep cooling pond, Shallow cooling pond.

The vertical stratification of cooling ponds was considered in a quasi-steady framework. Criteria based upon a nondimensional pond number were derived categorizing cooling ponds into the well-stratified deep pond type and into the partially mixed or vertically mixed shallow pond types. The well-stratified pond was characterized by an approximately uniform thin surface layer, and two-layer stratified flow theory was used to derive an equation for the layer thickness. An empirical expression described the degree of vertical stratification in shallow ponds as a function of pond number. Comparisons with field and laboratory data were given. The present results have several applications: in the selection of appropriate mathematical models for cooling pond prediction; in the definition of thermal zones for water quality studies or habitat zones for ecological studies; and in the design of cooling ponds to evaluate the effect of different combinations of pond geometry, discharge structure design, and choice of condenser design. In all of these applications one must keep in mind the quasi-steady nature of the proposed criteria; they predict the long-term mean thermal structure of a cooling pond. Short-term variations in natural meteorological forcing functions, or in plant operating conditions, can cause transient deviations from the mean structure; and on an annual basis, there may be a complete breakdown of any cooling pond stratification during winter in more extreme climate zones. (Humphreys-ISWS)
W80-05845

CARBONATE DEPOSITION AND FACIES DISTRIBUTION IN A CENTRAL MICHIGAN MARL LAKE,
Michigan Univ., Ann Arbor. Dept. of Geology and Mineralogy.
D. H. Murphy, and B. H. Wilkinson.
Sedimentology, Vol 27, No 2, p 123-135, April 1980. 11 Fig, 21 Ref. NSF EAR78-03634.

Descriptors: *Deposition(Sediments), *Lakes, *Michigan, *Marl, Sediment distribution, Facies(Sedimentary), Lake morphology, Carbonates, Calcite, Petrology, Peat, On-site investigations, Analysis, Chara, *Littlefield Lake(MI).

Relatively pure lacustrine carbonates referred to as marl are being deposited in Littlefield Lake, central Michigan, a hard-water lake with little terrigenous clastic influx. Thick accumulations of marl form both progradational marl benches along lake margins and islands or lakemounts in the lake center. Marl benches develop flat platforms up to 20 m wide in very shallow water and steeply inclined slopes, up to 30 deg, extending into deep water. The flat landward platform is frequently covered by algal pisoliths, while the upper portion of the lakeward-sloping bottom is overgrown by Chara which in the summertime becomes thickly encrusted with low-magnesian calcite. Marl islands are flat-topped features that formed over relict highs on Pleistocene drift which underlies the lake basin. These are fringed by marl benches identical to those found along lake margins. Marl benches are composed of four units: two this facies deposited on the shallow-water bench platform and two thicker facies deposited on the bench slope developed in moderate water depths. These in turn overlie a fifth facies deposited in deep water. A coarsening-upward sequence is developed in these sediments as a result of both mechanical sorting and primary production of carbonate sand and gravel in shallow water. In addition to facies sequences and size grading, trends upsection of increasing carbonate content and decreasing insoluble content may serve to identify temperate-region lacustrine carbonate deposits in the rock record. (Humphreys-ISWS)
W80-05854

STRATIFICATION VARIABILITY IN THREE MORPHOMETRICALLY DIFFERENT LAKES UNDER IDENTICAL METEOROLOGICAL FORCING,
Army engineer Waterways Experiment Statin, Vicksburg, MS. Environmental Lab.
D. E. Ford, and H. Stefan.
Water Resources Bulletin, Vol 16, No 2, p 243-247, April 1980. 5 Fig, 2 Tab, 7 Ref.

Descriptors: *Lakes, *Thermal stratification, Weather, Temperature, Air temperature, Solar radiation, Winds, Mixing, Cooling, Heating, On-site investigations, Surveys, Sampling, Limnology.

Synoptic water temperature measurements were taken in three temperate lakes located within 25 km of one another to study the effects of morphometry (and changes in weather) on seasonal and short-term thermal stratification characteristis. Two of the lakes had nearly the same surface areas and two had nearly identical mean depths; all were exposed to identical weather conditions. The dominance of weather over morphometry on the water surface temperature response was illustrated by the synoptic measurements in two different years. Stratification structure was also found to be dominated by weather for sufficiently deep lakes. Surface area effects were most subtle but explainable as sheltering effects. The onset of stratification was not, as traditionally described, a simple, gradual response of a lake to the annual solar radiation cycle. Rather it depends on a series of alternating heating, cooling, and mixing cycles similar to annual and diel cycles but with a period of approximately five days. These were in direct response to the passage of major weather systems and displayed no apparent time lag. No comparable synoptic water temperature data set could be found in the literature. (Sims-ISWS)
W80-05859

MODELING STORM OVERFLOW IMPACTS ON EUTROPHIC LAKE,
Limno-Tech, Inc., Ann Arbor, MI.
For primary bibliographic entry see Field 5B.
W80-05946

2I. Water In Plants

LEAF GROWTH, PHENOLOGICAL DEVELOPMENT AND YIELD OF WHEAT GROWN UNDER DIFFERENT IRRIGATION TREATMENTS,
Soil and Irrigation Research Inst., Pretoria (South Africa). Dept. of Agricultural Technical Services.
W. S. Meyer, and G. C. Green.
Water, S.A., Vol 6, No 1, p 21-26, January 1980. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Wheat, *Water requirements, *Moisture stress, *Plant growth, Irrigation effects, Leaves, Agriculture, Growth rates, Growth stages, Phenology, Soil-water-plant relationships, Moisture uptake, Water utilization.

In 1978, wheat (variety SST3) was used for experiments studying the relationships between leaf growth, water use, and yield. Rows of wheat were planted 200 mm apart with about 160 plants per sq m. Four types of irrigation treatments were used on the plots that were 12 m X 12 m. Irrigation was provided by a microjet system suspended 1 m above the ground. Weighing lysimeters were used to measure water use. Measurements of leaf growth and leaf area were taken daily. A pressure chamber was used to measure leaf water potential. Phenological observations were made weekly. Results show that leaf growth is highly responsive to diurnal temperatures when a water deficit does not exist. Low ambient temperatures at night did inhibit leaf growth. Water deficits were reflected in leaf growth area within several days. Following floral differentiation, mild water stress produced early anthesis; however, severe stress delayed anthesis. Some grains aborted following anthesis under severe water stress conditions. It is concluded that the sensitivity of plants to water deficits at different developmental stages can be affected by the rate of increase and severity of the water deficity. (Seigler-IPA)
W80-05758

A WEIGHING LYSIMETER FACILITY AT ROODEPLAAT FOR CROP EVAPOTRANSPIRATION STUDIES,
Soil and Irrigation Research Inst., Pretoria, (South Africa). Dept. of Agricultural Technical Services.
J. L. Hutson, G. C. Green, and W. S. Meyer.
Water S. A., Vol 6, No 1, p 41-46, January 1980. 3 Fig, 1 Tab, 20 Ref.

Descriptors: *Lysimeters, *Instrumentation, *Evapotranspiration, *Moisture content, Soil water, Water loss, Percolation, Wheat, Weight, Pressure, Data processing, Drying, Evaporation, Transpiration, *South Africa.

The design, construction, and performance of four recording mechanical lever/load beam combination lysimeters, installed in support of the irrigation research program at Roodeplaat, South Africa, are described. The lysimeters are installed in pairs on soils of the Shorrocks and Glendale series. The lysimeters have foundations and retaining walls of reinforced concrete with a sump to remove stormwater. The lysimeters themselves are 2 m x 2 m x 1 m steel tanks supported on a counter-balanced lever system, with a mechanical advantage of about 80:1. Water content changes are monitored by an electronic load beam. The data logger has three units, each recording onto separate tape cassettes. The cassettes are read into a desk computer for further data processing. The load beams have a guaranteed accuracy of 0.05% or 10N (0.2 mm of water). The load beams are infinite resolution transducers. Frictional forces associated with the mechanical lever system are responsible for the greatest inaccuracies of the system as a whole. The resolution of the measuring system is about 0.04 mm of water, with electronic noise sometimes introducing error. Calibration constants were established at two different times over different parts of the measuring range. Field performance is illustrated in a plot of hourly average water balance of wheat during a growing season. The lysimeters can continuously record water content changes of 0.1 mm while requiring no tare changes over the full range of soil water content. The lysimeters have been found to be accurate and reliable through two years of continuous operation. (Seigler-IPA)
W80-05759

FATE OF NUTRIENTS IN STREAMS DRAINING ORGANIC SOILS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
J. H. Peverly, and T. Potter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-200058, Price codes: A03 in paper copy, A01 in microfiche. Research Project Technical Completion Report, April 1980. 41 p, 10 Fig, 8 Tab, 19 Ref. OWRT A-079-NY(1), 14-34-0001-8034, 9034.

Descriptors: *Nutrients, *Organic soils, *Aquatic plants, Nutrient movement, Wetlands, *Sediments, Streamflow, Nutrient trap, Drainage.

Nutrient loads in water, sediment, and aquatic plants were monitored for two years in Oak Orchard Creek, draining in series cultivated organic soils (upstream) and managed wetlands (downstream). Dissolved concentrations (mg/l) ranged from 0.0 to 19 for N, 0.009 to 2 for P, 2 to 10 for K, 45 to 411 for Ca, and 10 to 102 for C. Eighty to 90 percent of the creek loads were carried from December through March and P loads actually exceeded N loads below the marshes in late summer. The managed wetlands acted as net nutrient sinks for N and P only, and than only for one year, but lost much less nutrient material on an area basis than did other parts of the basin. Elemental composition of the sediments and aquatic plant tissues was high and varied with position in the basin, not season. Plant growth was limited by physical factors. When flow and stream concentrations are low, such as in autumn, the N, P, K and C released by plant senescence could be a large fraction of total stream load.
W80-05793

RECENT VEGETATION CHANGES ALONG THE COLORADO RIVER BETWEEN GLEN CANYON DAM AND LAKE MEAD, ARIZONA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. M. Turner, and M. M. Karpiscak.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $6.00. Geological Survey Professional Paper 1132, 1980. 125 p, 73 Fig, 3 Plates, 3 Tab, 100 Ref.

Descriptors: *Vegetation, *Environmental effects, *Colorado River, *Arizona, *Streamflow, River regulation, Plant growth, Bermudagrass, Tamarisk, Riparian plants, Plant populations, Photography, *Glen Canyon Dam(AZ), *Lake Mead(AZ), Camelthorn, Russian olive.

Vegetation changes in the canyon of the Colorado River between Glen Canyon Dam and Lake Mead were studied by comparing photographs taken prior to completion of Glen Canyon Dam in 1963 with photographs taken afterwards at the same sites. In general, the older pictures show an absence of riparian plants along the banks of the river. The newer photographs of each pair were taken in 1972 through 1976 and reveal an increased density of many plant species. Exotic species, such as saltcedar and camel-thorn, and native riparian plants such as sandbar willow, arrowweed, desert broom and cattail, now form a new riparian community along much of the channel of the Colorado River between Glen Canyon Dam and Lake Mead. The matched photographs also reveal that changes have occurred in the amount of sand and silt deposited along the banks. Detailed maps are presented showing distribution of 25 plant species along the reach of the Colorado River studied. Data showing changes in the hydrologic regime since completion of Glen Canyon Dam are presented. (Kosco-USGS)
W80-05880

2J. Erosion and Sedimentation

SIMULATION OF SULFUR CYCLE IN ESTUARINE SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2K.
W80-05727

SEDIMENT OXYGEN DEMAND AND NUTRIENT RELEASE,
Duncan, Lagnese and Associates, Inc., Pittsburgh, PA.
P. S. Chiaro, and D. A. Burke.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE1, Proceedings Paper 15206, p 177-195, February 1980. 4 Fig, 7 Tab, 32 Ref, 1 Append.

Descriptors: *Sediments, *Oxygen demand, *Streams, *Water quality, Nutrients, Nitrogen, Ammonia, Phosphorus, Oxygen, Dissolved oxygen, Water temperature, Benthos, Respiration, Water pollution, Sampling, Data processing, Regression analysis, Sedimentation.

Benthic oxygen demand rates in these rivers ranged from 0.10 gm/m to 5.30 gm/sq m/day and were found to increase linearly with dissolved oxygen concentrations in the water overlying the sediment deposits. The oxygen uptake was found to be more closely related to the nutrient composition of the interstitial water of the sediments than to the nutrient composition of the sediment solids. Ammonia nitrogen release rates ranged from an apparent net uptake of 44 mg/sq m/day to a release of 505 mg/m, whereas total dissolved phosphorus exchange rates varied from a net uptake of 13 mg/sq m/day to a release of 138 mg/sq m/day. The release of ammonia nitrogen was related to the nitrogen content of both the interstitial water and solids portions of the sediment, and it appeared that biochemical mechanisms were principally responsible for ammonia nitrogen exchange processes. The exchange of total dissolved phosphorus was unrelated to measured nutrients within the sediments or overlying waters but was related to oxygen depletion, consistent with the widely accepted view that phosphorus exchange is controlled principally by oxidation-reduction reactions with iron, manganese, or sulfur, or all three. (Sims-ISWS)
W80-05729

METHODOLOGY FOR EFFLUENT WATER QUALITY PREDICTION,
University of Southern California, Los Angeles. Environmental Engineering Program.
For primary bibliographic entry see Field 5B.
W80-05730

MEASUREMENT OF WHOLE LAKE SEDIMENT ACCUMULATION AND PHOSPHORUS RETENTION USING LEAD-210 DATING,
McGill Univ., Montreal (Quebec). Dept. of Biology.
R. D. Evans, and F. H. Rigler.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 5, p 817-822, May 1980. 4 Fig, 1 Tab, 29 Ref.

Descriptors: *Sedimentation rates, *Radioactive dating, *Phosphorus, Lead radioisotopes, Retention, Sediments, Lake sediments, Cores Lakes, Sedimentation, Sampling, Limnology, *Bob Lake(Ontario), Phosphorus retention.

Lead-210 dating was used to measure rates of sediments accumulation in 15 cores from Bob Lake, Ontario. The rate of accumulation was highly correlated with sample depth. This relation allowed the calculation of accumulation of sediments over the whole lake area. Phosphorus (P) retention was calculated from mean concentration of P in the sediments and the whole lake accumulation of sediment. Retention of P calculated in this way was similar to retention calculated from previously measured input and output of P. (Sims-ISWS)
W80-05835

FLOWS ABOVE OSCILLATORY RIPPLES,
Research Inst. for Applied Mechanics, Fukuoka (Japan).
For primary bibliographic entry see Field 7B.
W80-05852

THE PATTERN OF NATURAL SIZE DISTRIBUTIONS,
Rickwoods and Mark Beech, Edenbridge (England).
For primary bibliographic entry see Field 7C.
W80-05853

CARBONATE DEPOSITION AND FACIES DISTRIBUTION IN A CENTRAL MICHIGAN MARL LAKE,
Michigan Univ., Ann Arbor. Dept. of Geology and Mineralogy.
For primary bibliographic entry see Field 2H.
W80-05854

SEDIMENT TRANSPORT IN THE TANANA RIVER IN THE VICINITY OF FAIRBANKS, ALASKA, 1977-78,
Geological Survey, Anchorage, AK. Water Resources Div.
R. L. Burrows, B. Park, and W. W. Emmett.
Available from OFSS Box 25425, Fed. Ctr. Denver, CO. 80225, Paper copy $5.50, Mirofiche $3.50. Geological Survey open-file report 79-1539, 1979. 37 p, 6 Fig, 21 Tab, 7 Ref.

Descriptors: *Sediment transport, *Streamflow, *Measurement, *Bed load, *Alaska, rivers, Flow rates, Geomorphology, Suspended load, Particle size, *Tanana River(Alaska), Fairbanks area(Alaska).

Measurements of the sediment load of the Tanana River in the vicinity of Fairbanks, Alaska, show that suspended-sediment transport rate in tons per day, relates to water discharge, in cubic feet per second, as: Suspended-sediment transport rate (tons/day) = 5.717 x 10 to the minus 8th power x water discharge (cubic feet/second) to the 2.713 power, (where the correlation coefficient squared = 0.967). The bedload-transport rate is approximately 1 to 2 prcent of the suspended-sediment transport rate. Data collected at Fairbanks and upstream from Fairbanks near North Pole, Alaska, show little difference in size distribution of suspended sediment between the two locations. The median particle size distribution of suspended sediment is generally in the silt range, but at some low-water discharges, the median particle size is in the very fine sand range. The median particle size is in the very fine sand range. The median particle size of bedload near Noth Pole is generally in the gravel range, but at some low transport rates, the median particle size is in the medium sand range. At Fairbanks, data collected in 1977 indicate median particle sizes of bedload comparable to those of the upstream location, whereas data collected in 1978 indicate a marked decrease in median particle size of bedload between the two locations. For both locations and at all water discharges and sediment transport rates, particles constituting the suspended load are significantly smaller than particles constituting the bedload. (Kosco-USGS)
W80-05872

FLUIDIZED BED ELUTRIATION OF CARBONATE SANDS,
Cambridge Univ. (England). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 7B.
W80-05935

CRITERIA FOR THE INSTABILITY OF UPPER-STAGE PLANE BEDS,
Reading Univ. (England). Sedimentology Research Lab.
J. R. L. Allen, and M. R. Leeder.
Sedimentology, Vol 27, No 2, p 209-217, April 1980. 4 Fig, 33 Ref.

Descriptors: *Sediment transport, *Erosion, *Boundary processes, *Bottom sediments, Reviews, River beds, Beds, Deposition(Sediments), Laboratory tests, Analytical techniques, Shear stress, Regime, Movement, Tractive forces, Bed load, Ripple marks, Shape, Sand waves, Dunes.

Calculations of the critical dimensionless bed stresses that obtain when upper-stage plane beds should revert to ripple and dune bed forms were

presented. Strong support was given to the Bagnold 'universal' plane-bed instability criterion and to a modified criterion suggested by Allen over a wide range of solids grain size. A reinterpretation of the mechanism of plane bed instability was based upon the extent to which significant grain concentrations in plane bed flows increase apparent fluid viscosity and decrease turbulence production over potential bed defects, thereby preventing ripple or dune propagation and growth. (Humphreys-ISWS)
W80-05936

AQUEOUS-AND SEDIMENT-PHASE NITROGEN YIELDS FROM FIVE SOUTHERN PINE WATERSHEDS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W80-05939

2K. Chemical Processes

GROUND-WATER-QUALITY DATA FROM THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. W. Lee.
Available from OFSS Bx 25425, Fed. Ctr. Denver, CO., paper copy $8.75, microfiche $4.00. Geological Survey open-file report 79-1331 (WRI), October 1979. 55 p, 2 Fig, 1 Plate, 3 Tab, 5 Ref.

Descriptors: *Groundwater, *Water quality, *Data collections, *Montana, *Chemical analysis, Water wells, Springs, Trace elements, Radiochemical analysis, *Northern Powder River basin, *Southeastern Montana.

Water-quality data collected during 1973-77 for hydrologic studies in the northern Powder River basin of southeastern Montana provide a data base for shallow ground water. The 665 water samples collected were analyzed for major cations and anions. Of the samples, 516 were from wells and 149 were from springs. About 10 percent of the samples were also analyzed for trace constituents and radiochemistry. The majority of analyses were performed by the Montana Bureau of Mines and Geology laboratory in Butte, Montana. The remaining analyses, including all trace constituent and radiochemical analyses, were performed by the U.S. Geological Survey National Water Quality Laboratory in Denver, Colorado. (Kosco-USGS)
W80-05717

THE MASS BALANCE APPROACH: APPLICATION TO INTERPRETING THE CHEMICAL EVOLUTION OF HYDROLOGIC SYSTEMS,
Geological Survey, Reston, VA. Water Resources Div.
L. N. Plummer, and W. Back.
American Journal of Science, Vol 280, p 130-142, February 1980. 3 Fig, 3 Tab, 22 Ref.

Descriptors: *Chemical analysis, *Mass transfer, *Analytical techniques, *Groundwater, *Water analysis, Isotope studies, Chemical reactions, Water chemistry, Carbonates, Air-water interfaces, Aquifers, Gypsum, Anhydrite.

Mass-balance and mass-transfer calculations are applied to observed chemical and isotopic data of three natural water systems involving carbonate reactions in order to define mineral stoichiometry of reactants and products, relative rates of reactions, and mass transfer. One study evaluates reactions in a lagoon on the east coast of the Yucatan Peninsula, Mexico, into which ground water discharges and mixes with seawater. Mass-transfer calculations are used to test the extent to which conservative mixing reactions, carbon dioxide gas evolution across the water-air interface and dissolution and (or) precipitation of calcium carbonate influence the observed water chemistry. Two other examples deal with identification of reactions, mass transfer, and relative rates of reactions in parts of the Tertiary limestone aquifer of Florida and the Mississippian limestone (Madison) aquifer near the Black Hills, S. Dak. Both ground-water systems are driven irreversibly by solution of gypsum or anhydrite, a reaction that causes additional solution of dolomite and precipitation of calcium carbonate (dedolomitization). Introduction of total time required for the derived mass transfer to take place permits comparison of apparent rates of reactions among hydrologic systems. (Kosco-USGS)
W80-05719

SIMULATION OF SULFUR CYCLE IN ESTUARINE SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
D. A. Bella, and K. J. Williamson.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE1, Proceedings Paper 15174, p 125-143, February 1980. 8 Fig, 5 Tab, 21 Ref, 2 Append. NSF ENV71-01908.

Descriptors: *Sediments, *Estuaries, *Sulfur, *Model studies, Mathematical models, Sulfur compounds, Bacteria, Sulfur bacteria, Sulfates, Sulfides, Iron, Carbon, Chemicals, Benthos, Biological communities, Estuarine sediments, Sulfur cycle.

A mathematical model of estuarine sediment was developed using rate coefficients and field measurements. The model had a particular emphasis on the sulfur cycle and included specific chemical components of dissolved oxygen, soluble organic carbon, sulfates, free sulfides, total sulfides, sulfide capacity, sulfur, and pyrite. Different levels of sediment organics (OCS) and turnover rates (RST) were mathematically imposed, and the subsequent levels of chemical components were determined after a 210-day period. General chemical properties were identified for a RST-OCS plane. (Sims-ISWS)
W80-05727

ROLE OF RILL DEVELOPMENT IN SALT LOADING FROM HILLSLOPES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
G. K. Sunday.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-199540, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, Fall, 1979. 117 p, 54 Fig, 13 Tab, 17 Ref, 1 Append. OWRT B-170-COLO(2).

Descriptors: *Colorado River, *Salinity, *Rill erosion, *Soil erosion, Hortons law, Drainage, Shales, Weathering, Deterioration, Rainfall-runoff relationships, Overland flow, Slopes, Colorado.

A field study, a computer simulation, and flow velocity experiments were used to identify the major contributing factors in salt loading of the Colorado River from hillslopes above the river. The field study of artificially induced runoff over Mancos shale was conducted on sites with little vegetation located north of the Grand Junction, Colorado, airport and in the West Salt Creek Basin near Mack, Colorado. The longitudinal slopes ranged from 7 to 41 degrees with lengths of from 40 to 225 feet. Two sources of water were used: (1) direct runoff applied from a perforated pipe, and (2) runoff from a rain sprinkler system. Rill formation was recorded with careful field notes and movie films. Results show a well-defined relationship between salinity of runoff and slope for direct runoff. Major factors in salt loading were identified as (1) amount of runoff, (2) suspended sediment concentrations associated with rill flow, (3) degree of slope, (4) salt potential of the soil, and (5) method of introduction of flow. In the study of rill development by computer simulation, a hypothetical drainage area is represented by a square (100 x 100) matrix, and rill patterns are generated by a series of moves between adjacent points in the matrix. Drainage patterns resulting from the simulation are checked against Horton's laws of drainage composition. In a laboratory control situation, three loading factors were studied: (1) increased flow velocites, (2) different layers of Mancos shale (unweathered and weathered), and (3) particle size of shale. Unweathered shales were found to yield more salt than weathered shales if equally exposed surface area is considered. (Seigler-IPA)
W80-05752

OBSERVATIONS ON THE ESTIMATION OF TOTAL ORGANIC CARBON FROM U.V. ABSORBANCE FOR AN UNPOLLUTED STREAM,
Aberdeen Univ. (Scotland). Dept. of Soil Sciences.
J. M. Reid, M. S. Cresser, and D. A. MacLeod.
Water Research, Vol 14, No 5, p 525-529, 1980. 3 Fig, 1 Tab, 12 Ref.

Descriptors: *Ultraviolet radiation, *Natural streams, *Organic matter, Sampling, Measurement, On-site investigations, Analysis, Analytical techniques, Data collections, Foreign research, Watersheds(Basins), Runoff, Running waters, Streams, *United Kingdom, *River Dye(UK), Organic carbon, Ultraviolet absorbance.

The purpose of the present work, which constitutes part of a detailed catchment study, was to establish whether total organic carbon could be estimated in an unpolluted stream from u.v. absorbance measurements under a wide range of flow conditions, and to investigate the importance of any seasonal trends or fluctuations with flow. The concentration of total organic carbon in unpolluted stream water may be estimated from measurement of absorbance at 250 nm. However, unless allowance is made for the change in the composition of this organic matter under diverse flow conditions, the estimation is subject to serious systematic errors, particularly at low carbon concentrations. Grouping data according to flow at time of sampling leads to a considerable improvement in the accuracy of the estimation, but requires the use of three regression equations. The resulting procedure is then, however, valid under a wide range of flow conditions. (Humphreys-ISWS)
W80-05779

FATE OF NUTRIENTS IN STREAMS DRAINING ORGANIC SOILS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 2I.
W80-05793

RELATIONSHIPS BETWEEN METABOLIC PARAMETERS AND STREAM ORDER IN OREGON,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
R. J. Naiman, and J. R. Sedell.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 5, p 834-847, May 1980. 9 Fig, 8 Tab, 42 ref. NSF BMS75-0733.

Descriptors: *Metabolism, *Streams, *Rivers, *Oregon, Sampling, Chlorophyll, Water temperature, Discharge(Water), Streamflow, Nutrients, Nitrogen, Phosphorus, Alkalinity, Primary productivity, Detritus, Photosynthesis, Light, Respiration , Biology.

The light regime, standing stock of chlorophyll, and five metabolic parameters were measured seasonally at four Oregon stream sites: Devils Club Creek (1st order), Mack Creek (3rd order), Lookout Creek (5th order), and the McKenzie River (7th order). Periphyton from pools and riffles, aquatic moss (Fontinalis), fine particulate organic matter (FPOM: 0.5 mirometer-1 cm), and coarse particulate organic matter (CPOM: greater than 1 cm) were examined separately for gross production (GP), net community production (NCP), diel respiratin (R sub 24), net daily metabolism (NDM), and the production to respiration (P:R) ratio. Total autotrophic production was found to increase in a downstream direction where more light is available: however, the efficiency of light utilization is greatest in heavily shaded Mack Creek. Detrital metabolism, per unit weight, is similar in all streams for each metabolic parameter. The standing stock of detritus though is highest in headwater streams, decreasing as streams become larger. Therefore, the relative contribution of the detritus

community to total metabolism decreases downstream. Mosses occur in significant quantities only in the McKenzie River and have an areal community respiration rate about twice that of periphyton; other metabolic parameters are nearly equal in this case, On an areal basis periphyton metabolism is much greater than detrital metabolism, and as a consequence, total stream metabolism and the P:R ratio increase downstream. (Sims-ISWS)
W80-05813

KINETIC MODEL FOR THE SHORT-TERM DISSOLUTION OF A RHYOLITIC GLASS,
Geological Survey, Denver, CO. Water Resources Div.
A. F. White, and H. C. Claassen.
Chemical Geology, Vol 28, p 91-109, 1980. 8 Fig, 5 Tab, 35 Ref.

Descriptors: *Geochemistry, *Kinetics, Model studies, *Groundwater, *Rhyolites, Ion exchange, Diffusion, Water chemistry, Adsorption, *Dissolution, *Volcanic glass.

Aqueous dissolution experiments with the vitric phase of a rhyolitic tuff were performed at 25 C and constant pH in the range 4.5 to 7.5. Results suggest interchange of aqueous hydrogen ions for cations situated both on the surface and within the glass. At time intervals from 24 to 900 hours, dissolution kinetics are controlled by ion transport to and from sites within the glass. Experimental data indicate that parabolic diffusion rate of a chemical species from the solid is a nonlinear function of its aqueous concentration. A numerical solution to Fick's second law is presented for diffusion of sodium, which relates its aqueous concentration to it's concentration on glass surface, by a Freundlick adsorption isotherm. The pH influence on sodium diffusion in the model can be accounted for by use of ph-dependent diffusion coefficient and a pH-independent adsorption isotherm. (Kosco-USGS)
W80-05870

ACID PRECIPITATION AND SULFATE DEPOSITION IN FLORIDA,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
P. L. Brezonik, E. S. Edgerton, and C. D. Hendry.
Science, Vol 208, No 4447 p 1027-1029, May 30, 1980. 2 Fig, 1 Tab, 14 Ref. EPA R805560.

Descriptors: *Precipitation(Atmospheric), *Acidity, *Sulfur, *Florida, Sampling, Monitoring, Sulfates, Data processing, Hydrogen ion concentration, Sulfur compounds, Acids, Chemistry, Air pollution, Water pollution, Rainfall, Chemistry of precipitation, Acid precipitation.

The acidity of rainfall in Florida has increased markedly in the past 25 years, and the average sulfate and nitrate concentrations have incrased by factors of 1.6 and 4.5, respectively, over the period. Annual average pH values below 4.7 now occur over the northern three quarters of the state. Summer rainfall has average pH values 0.2 to 0.3 unit lower than winter rainfall, and sulfate concentrations at most sites are higher in summer. The annual deposition of H(+) (about 300 to 500 equivalents per hectare) in north Florida is a third to a half of the deposition in the heavily impacted northeastern United States; comparable figures for excess sulfate (derived from sulfurdioxide) are 7 to 11 kilograms of sulfur per hectare or 50-90% of the sulfate deposition rates at Hubbard Brook, New Hampshire. (Sims-ISWS)
W80-05934

2L. Estuaries

SIMULATION OF SULFUR CYCLE IN ESTUARINE SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2K.
W80-05727

POWER FROM WAVES USING HARBOR RESONATORS,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
W. James.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 106, No WW1, Proceedings Paper 15210, p 99-113, February 1980. 8 Fig, 26 Ref, 2 Append.

Descriptors: *Harbors, *Tidal energy, *Resonance, *Ocean waves, Inlets(Waterways), Sediments, Wave pile-up, Sediment transport, Littoral drift, Waves(Water), Equations, Mathematical models, Model studies, *Harbor structures, Resonators, Wave energy.

This paper described an experimental investigation into return flow generated by rectangular resonators on semi-infinite harbor entrances. The study included: the band-width of the reduced energy spectrum transmitted into a harbor, the concomitant reflected wave spectra, and the energy available for return flow. This paper was intended to provide data for the design of on-channel harbor resonators to: (1) eliminate or reduce the transmission of a selected band or harmful wave frequencies; or (2) maximize orbital velocities near the bed so as to prevent the influx and deposition of littoral sediments in harbor entrances; or (3) maximize return flow power extracted from the wave action in the resonators, or all three. (Lee-ISWS)
W80-05732

SEDIMENT-WATER CHEMICAL EXCHANGE IN THE COASTAL ZONE TRACED BY IN SITU RADON-222 FLUX MEASUREMENTS,
North Carolina Univ. at Chapel Hill. Marine Sciences Program.
C. S. Martens, G. W. Kipphut, and J. V. Klump.
Science, Vol 208, No 4441, p 285-288, April 1980. 3 Fig, 1 Tab, 27 Ref. NSF OCE75-06199, OCE78-9453.

Descriptors: *Sediment-water interfaces, *Boundary processes, *Coasts, *North Carolina, On-site investigations, Radioisotopes, Methane, Ammonia, On-site data collections, Tracers, Testing procedures, Diffusion, Methodology, Tidal effects, Analytical techniques, Analysis, *Cape Lookout(NC), In situ tests, Radon.

In situ radon-222 flux experiments conducted in benthic chambers in Cape Lookout Bight, a small marine basin on the North Carolina coast, reveal that enhanced chemical transport across the sediment-water interface during summer months is caused by abiogenic bubble tube structures. Transport rates for dissolved radon, methane, and ammonium more than three times greater than those predicted on the basis of molecular diffusion occur when open tubes are maintained by semidiurnal low-tide bubbling. Enhanced sediment-water chemical exchange can therefore occur in organic-rich coastal sediments in the absence of macroinfaunal irrigation and current-induced physical mixing. Radon-222 is an excellent in situ tracer for such processes in the coastal zone. (Humphreys-ISWS)
W80-05765

NUTRIENT DISTRIBUTIONS IN THE CANADIAN ARCHIPELAGO: INDICATORS OF SUMMER WATER MASS AND FLOW CHARACTERISTICS,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
E. P. Jones, and A. R. Coote.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 4, p 589-599, April 1980. 9 Fig, 2 Tab, 19 Ref.

Descriptors: *Nutrients, *Canada, *Sounds, *Surface waters, *Arctic Ocean, Distribution, Bays, Phosphates, Nitrates, Silicates, Spatial distribution, Mixing, Flow characteristics, Salinity, On-site investigations, On-site data collections, Water circulation, Water quality, *Canadian Archipelago, *Smith Sound, *Fram Sound, *Lancaster Sound, *Jones Sound.

Concentrations of the nutrients, phosphate, nitrate, and silicate, were measured at several locations in Lancaster Sound, Jones Sound, and Smith Sound. Arctic Ocean surface layer water flowing out through Lancaster Sound and Jones Sound has higher phosphate and silicate concentrations than that flowing out through Smith Sound. Phosphate and silicate concentrations can be useful to indicate flow patterns within some regions of the Canadian Archipelago and to delineate partially the gyre in the Canadian Basin of the Arctic Ocean. (Humphreys-ISWS)
W80-05771

PADDLE GENERATED WAVES IN LABORATORY CHANNELS,
Scripps Institution of Oceanography, La Jolla, CA. Shore Processes Lab.
R. E. Flick, and R. T. Guza.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 106, No WW1, Proceedings Paper 15175, p 79-97, February 1980. 6 Fig, 1 Tab, 23 Ref, 2 Append. ONR N00014-C-0300.

Descriptors: *Waves(Water), *Laboratory tests, *Model studies, *Mathematical models, Theoretical analysis, Ocean waves, Coastal engineering, Oceans, Coasts, Beaches, Frequency, Resonance, Engineering, Paddle generated waves, Wave generation.

The wave field generated by single frequency and biharmonic motion of a plane paddle wavemaker was investigated theoretically and in laboratory experiments. Regardless of the detailed paddle geometry, nonlinear effects associated with the paddle boundary conditions introduce free waves which are the order of forced nonlinear corrections (Stokes type) associated with nonlinearities of the surface boundary conditions. For simple harmonic paddle motion at frequency sigma, the largest free waves have frequency 2 sigma. For biharmonic paddle motions of frequencies sigma sub 1 and sigma sub 2, additional free difference frequency (sigma sub 1 - sigma sub 2) long waves are generated. These can resonate in a closed basin, leading to undesired modulations of breaker location and other shallow water phenomenon. (Sims-ISWS)
W80-05776

C & D CANAL EFFECT ON SALINITY OF DELAWARE ESTUARY,
Najarian, Thatcher and Associates, Inc., Demarest, NJ.
T. O. Najarian, M. L. Thatcher, and D. R. F. Harleman.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 106, No WW1, Proceedings Paper 15172, p 1-17, February 1980. 12 Fig, 3 Tab, 13 Ref, 1 Append.

Descriptors: *Canals, *Estuaries, *Salinity, *Model studies, *Chesapeake Bay, Mathematical models, Flow, Tides, Tidal effects, Currents(Water), Hydrodynamics, Hydraulic transients, *Delaware Estuary.

Analysis of the effect of C & D Canal on the salinity intrusion in the Delaware Estuary was described. Two separate mathematical models were used: MIT-Dynamic Network Model and MIT-Transient Salinity Intrusion Model. Emphasis was put on the investigation of simulated responses in the Delaware, rather than the Canal. The primary objective of the study was the investigation of salinity distribution in the Delaware under different forcing functions. MIT-DNM application revealed the behavior of a coupled Canal/Delaware system under natural boundary conditions specified at the Chesapeake Bay, Capes May and Henlopen, and at the head of tide at Trenton. MIT-TSIM application showed temporal and spatial salt distribution in the Delaware with salt and net flow condition specifications in the Canal. The results of these simulations indicated that salinity in the Delaware Estuary is appreciably affected by the dynamics of the Canal. However, the Canal has little discernible effect on the hydrodynamics of the Delaware. (Sims-ISWS)

W80-05777

EFFECTS OF MODERATE SEWAGE INPUT ON BENTHIC POLYCHAETE POPULATIONS,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
D. M. Dauer, and W. G. Conner.
Estuarine and Marine Science, Vol 10, No 3, p 335-346, March 1980. 3 Fig, 3 Tab, 27 Ref. EPA R-802928.

Descriptors: *Bays, *Florida, *Aquatic environment, *Benthic fauna, Sediments, Biomass, Estuaries, Benthos, Tidal waters, On-site investigations, Sampling, Analysis, Aquatic populations, On-site data collections, *Tampa Bay, Polychaetes, Biological data.

The study site was located in Old Tampa Bay, Florida. The polychaete fauna of a sandy intertidal habitat receiving effluent from a sewage treatment plant was compared to that of a control site. The total number of individuals, total biomass, and average species numbers were significantly greater at the sewage-affected site. The response of individual species to nutrient enrichment varied. Some species showed significantly greater numbers of individuals at the sewage-affected site, while other species' densities showed no difference. All species maintained greater biomass at the enriched site, most biomass differences were significant. Those species that did not show density differences between sites tended to have the greatest difference in average weight per individual. In general, species with either benthic development or some form of brooding behavior were best able to exploit the enriched condition by increased densities or greater average biomass per individual. It was concluded that for moderate increases in nutrient concentrations, benthic productivity will be most enhanced in those sediments with very low concentrations of fine sized particles. (Humphreys-ISWS)
W80-05783

ANALYSES OF SEA LEVEL FLUCTUATIONS IN THERMAICOS GULF AND SALONICA BAY, NORTHWESTERN AEGEAN SEA,
University Coll. of Swansea (Wales). Dept. of Oceanography.
A. Wilding, M. Collins, and G. Ferentinos.
Estuarine and Coastal Marine Science, Vol 10, No 3, p 325-334, March 1980. 9 Fig, 2 Tab, 10 Ref.

Descriptors: *Sea level, *Tides, *Water level fluctuations, *Bodies of water, Fluctuations, Bays, Gulfs, Analysis, Analytical techniques, On-site investigations, On-site data collections, Frequency, Foreign research, *Aegean Sea, *Thermaicos Gulf, *Salonica Bay, Spectral analysis.

Short period (2.4 to 2.7 h) and long period (several days) oscillations of nontidal origin have been identified in the analysis of a short series of sea level records from stations in Salonica Bay and Thermaicos Gulf. Oscillations of short period can be attributed to seiche-like motions; those of long period correspond with variations in barometric pressure. The harmonic constituents are generally indicative of a standing tidal wave over the whole of the area. (Humphreys-ISWS)
W80-05784

POLAROGRAPHIC MEASUREMENT OF MANGANESE (II) IN ESTUARINE WATERS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
S. Knox, and D. R. Turner.
Estuarine and Coastal Marine Science, Vol 10, No 3, p 317-324, March 1980. 3 Fig, 3 Tab, 17 Ref.

Descriptors: *Estuaries, *Manganese, *Water properties, *Polarographic analysis, Analytical techniques, Chemical analysis, Laboratory tests, Methodology, Colloids, Colorimetry, Sampling, Surveys, On-site data collections, Foreign research, *England, *Tamar Estuary(England).

The application of differential pulse polarography to the estimation of manganese (II) in estuarine waters was described. The method was assessed and used in the concentration range 10-300 micrograms/l. Polarographic manganese measurements on samples obtained from the Tamar Estuary (SW England) were compared with colorimetric measurements of total dissolved manganese, and it was shown that polarographically determined manganese (II) can vary widely from 100% to less than 10% of the total dissolved manganese. It was suggested that the manganese not measured by the polarographic method is in colloidal form. (Humphreys-ISWS)
W80-05785

POLLEN EVIDENCE FOR HISTORIC SEDIMENTATION RATES IN CALIFORNIA COASTAL MARSHES,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Geology.
P. J. Mudie, and R. Byrne.
Estuarine and Coastal Marine Science, Vol 10, No 3, p 305-316, March 1980. 4 Fig, 2 Tab, 30 Ref.

Descriptors: *Coastal marshes, *California, *Dating, *Sedimentology, Salt marshes, History, Pollen, Tracers, Recent epoch, Radioactive dating, On-site investigations, Sampling, Analysis, Carbon radioisotopes, *Marin County(CA), *San Diego County(CA).

The pollen of alien weeds and ornamentals was used to determine sedimentation rates in four California coastal salt marshes. The results indicated that during the present century sedimentation rates have been ca. 50 cm/100 years in southern California and 10 cm/100 years in central California. This regional contrast was interpreted to be primarily the result of differences in land use history, although 'natural' environmental differences are apparently also involved. Radiocarbon dates indicated that pre-European sedimentation rates were ca. 10 cm/100 years in southern California and ca. 5 cm/100 years in central California. (Humphreys-ISWS)
W80-05786

DEPOSITION OF DREDGED SEDIMENT AT OPEN WATER SITES,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
H. J. Bokuniewicz, and R. B. Gordon.
Estuarine and Coastal Marine Science, Vol 10, No 3, p 289-303, March 1980. 7 Fig, 2 Tab, 10 Ref, 1 Append.

Descriptors: *Dredging, *Spoil banks, *Deposition(Sediments), *Coasts, Disposal, Settling velocity, Sites, Spatial distribution, Methodology, Mathematical models, Dispersion, Sampling, Surveys, On-site investigations, Theoretical analysis, Turbidity, Physical properties, Lakes, Laboratory tests, Deformation.

Silt-clay dredge spoil released at the surface of near-shore waters is deposited on the sea floor within a few hundred meters of its impact point. Only a few percent of the spoil is lost into the water column in most disposal operations. Surveys of the deposits formed by the controlled release of dredged sediment show some to be compact (presenting minimum surface area to the ambient water) and others dispersed (extending over a large area as a thin layer). The principal factor controlling the degree of dispersion during placement is the cohesion of the spoil. Disaggregated spoil is deposited from a turbidity current in a thin annulus, aggregated or cohesive spoil, in a compact pile of discrete blocks or 'clods'. Formation of a compact deposit of spoil requires that the clods survive impact with the bottom; their kinetic energy must be absorbed in plastic deformation without clod rupture. The impact speed and the kinetic energy density were calculated for free fall of clods in water. Laboratory measurements were made of the deformation-rate dependence of the mechanical work done to rupture clods of silt-clay marine sediment in impact. These show that plastic deformation will dissipate the impact energy for clods less than 0.8 m in diameter; larger clods will break up upon impact. Field observations confirm the presence of clods smaller than this in deposits of cohesive spoil. The disposal processes responsible for the formation of spoil deposits are insensitive to the water depth and current speed. A compact spoil deposit is most likely to result when cohesive sediment is dredged with a clam shell bucket and released in small quantities at low speed over a soft-bottomed disposal area. (Humphreys-ISWS)
W80-05787

DAILY, SEASONAL, AND ANNUAL FLUCTUATIONS AMONG ZOOPLANKTON POPULATIONS IN AN UNPOLLUTED TROPICAL EMBAYMENT,
Harbor Branch Foundation, Fort Pierce, FL.
M. J. Youngbluth.
Estuarine and Coastal Marine Science, Vol 10, No 3, p 265-287, March 1980. 12 Fig, 6 Tab, 39 Ref. AT (40-1)1833.

Descriptors: *Fluctuations, *Zooplankton, *Bays, *Aquatic environment, *Puerto Rico, Annual, Seasonal, Tropic, Estuaries, On-site data collections, On-site investigations, Copepods, Aquatic populations, Sampling, Laboratory tests, Analysis, Variability, Biomass, Diurnal, Density, *Jobos Bay(PR), Daily.

During 1973-74 biweekly collections of zooplankton in Jobos Bay, Puerto Rico, revealed that major differences in the abundance and variety of several populations were related to water circulation, seasonal rainfall, and diel behavior. Total densities of zooplankton ranged from 225 to 9050/cu m for night and 30 to 4700/cu m for day samples. Abundance levels increased about twofold from coastal to isolated regions of the bay, but at least twice as many species occurred in the coastal areas. Rapid, short-term changes in abundance, pulses of about one order of magnitude, occurred shortly before and during the wet season. Diel differences in density, most notable among the copepod, Acartia tonsa, coincided with a seasonal increase in abundance. The size and composition of the zooplankton communities in Jobos Bay were similar to those found in one polluted, tropical embayment (Guayanilla Bay, Puerto Rico) but differed greatly from those described in another (Kingston Harbour, Jamaica). (Humphreys-ISWS)
W80-05788

DYNAMICS OF PHYTOPLANKTON PRODUCTIVITY IN THE PECONIC BAY ESTUARY, LONG ISLAND,
New York Ocean Science Lab., Montauk.
S. F. Bruno, R. D. Staker, and G. M. Sharma.
Estuarine and Coastal Marine Science, Vol 10, No 3, p 247-263, March 1980. 10 Fig, 2 Tab, 32 Ref. State of NY. C114053, C146859.

Descriptors: *Estuaries, *Phytoplankton, *Primary productivity, *Ecosystems, *New York, Chlorophyll, Bays, Estuarine environment, Physicochemical properties, Spatial distribution, Dynamics, Water quality, Nitrogen, Nutrients, On-site investigations, Water temperature, On-site data collections, Salinity, Analysis, Dissolved oxygen, Tidal effects, *Peconic Bay(NY), *Long Island(NY), Species diversity, Tidal flushing.

Throughout most of the year chlorophyll a specific productivity (mg C/mg Chl a/d) was regulated by mean photic zone light energy. During spring and early summer, however, nutrients may occasionally be important regulators of primary productivity in Little Peconic Bay, and possibly Great Peconic Bay as well. Nitrogen and silica are the nutrients implicated. Regression analysis of NO3(-)-N vs. chlorophyll a and dissolved inorganic nitrogen vs. chlorophyll a indicate that nitrogen is important in controlling the upper limit of biomass production in the ecosystem except for Flanders Bay where nitrogen appears to be in excess. Horizontal distribution of chlorophyll a is related to tidal flushing through Gardiners Bay, and hypereutrophication of Flanders Bay is prevented by this physical dispersion and mixing. Annual estimates of phytoplankton productivity in the bay system range from 162 to 213 g C sq m/y and are in good agreement with many other estuaries of the northwest Atlantic coast. Phytoplankton community composition and diversity indices were discussed. (Humphreys-ISWS)

W80-05789

DISCUSSION OF THE TURBIDITY MAXIMUM IN PARTIALLY MIXED ESTUARIES,
Dartmouth Coll., Hanover, NH. Dept. of Earth Sciences.
C. B. Officer.
Estuarine and Coastal Marine Science, Vol 10, No 3, p 239-246, March 1980. 4 Fig, 4 Ref.

Descriptors: *Turbidity, *Estuaries, *Sediment transport, *Model studies, Mixing, Suspended solids, Mathematical models, Spatial distribution, Circulation, Tidal effects, Velocity, Salinity, Numerical analysis, Analytical techniques, Equations, Box models.

A set of box model equations was developed to define the suspended sediment distribution and turbidity maximum related to gravitational circulation effects. The box model gives a reasonable, first order approximation to the numerical model results for the suspended sediment distribution, turbidity maximum related to gravitational circulation effects, longitudinal suspended sediment fluxes, and the hydrodynamic variables. It should not, however, be considered as a substitute for the numerical model. The advantage of the box model is that within its limitations it can be applied to actual conditions in partially mixed estuaries in which the horizontal net circulation exchanges are dominant over the horizontal nonadvective exchanges. It can be extended to the non-conservative case of sediment flux exchanges with the bottom to determine first order values for the net erosion or deposition along the estuary and to estimate the effects related to local resuspension by tidal currents as well as the net longitudinal fluxes from the river and ocean to the estuary. The input data that are needed for such calculations are the salinity distribution, estuary geometry, river flow, and the suspended sediment distribution. Although the numerical model is more informative scientifically, it is somewhat more difficult in application, for it assumes constant estuary coefficients, a rectangular estuary geometry of constant depth and width, and a conservative condition with respect to the estuary bottom. (Humphreys-ISWS)
W80-05790

GROUNDWATER SEEPAGE INTO GREAT SOUTH BAY, NEW YORK,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
H. Bokuniewicz.
Estuarine and Coastal Marine Science, Vol 10, No 4, p 437-444, April 1980. 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Bays, *Seepage, *Groundwater, *New York, On-site investigations, Coasts, Lagoons, Measurement, Groundwater movement, Discharge(Water), Hydrography, Flow, On-site tests, Methodology, On-site data collections, Freshwater, *Great South Bay(NY).

Great South Bay (New York) is a large lagoon on the northeast coast of the United States. The flow of groundwater across the floor of Great South Bay has been reported to account for as much as 2/3 of the total freshwater inflow. In situ measurements of this seepage flow have been made along four offshore transects in the bay. These measurements show that the flow rate decreases rapidly offshore; within 30 m of the shoreline, the submarine outflow rates were typically 40 l/(day sq m) and decreased to less than 10 l/(day sq m) at a distance of 100 m from shore. The bay floor at the study locations was sand or silty sand with vertical intrinsic permeabilities ranging from 14 to 78 darcys. The flow rate across the bay floor may be described by an exponentially decreasing function. The flow distribution may, therefore, be specified with two parameters--the flow value at the shoreline, A, and a 'decay' constant, c, that governs the rate of decrease of the flow offshore. The calculated flows along the four transects were 2100, 1100, 8500, and 3900 l/(day m). Between 40% and 98% of this flow enters the bay within 100 m from shore. The total flow of groundwater across the bay floor was calculated to be about 2 x 10 to the 8th power l/day or 10-20% of the total freshwater inflow. (Humphreys-ISWS)

W80-05815

A COMPARISON OF TIDAL HARMONIC CONSTANTS COMPUTED AT AND NEAR AN INLET,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
N. P. Smith.
Estuarine and Coastal Marine Science, Vol 10, No 4, p 383-391, April 1980. 2 Fig, 2 Tab, 9 Ref.

Descriptors: *Inlets(Waterways), *Tides, *Forecasting, *Florida, Tidal waters, Water levels, Time series analysis, Water pressure, Fourier analysis, Analytical techniques, Analysis, Hydrography, Coasts, *Fort Pierce Inlet, Hydrographic data.

In this study, bottom pressures from inner shelf waters off South Florida's Atlantic coast were compared with water level measurements made at the Fort Pierce Inlet to investigate the spatial variations in the harmonic constants of the principal tidal constituents in the immediate vicinity of an inlet. The purpose was to demonstrate the existence of significant differences over short distances, and to call attention to the implication this might have with regard to the construction of co-range and co-tidal charts for the adjacent ocean basin. Time series of bottom pressure and surface water level were used to compute harmonic constants and thus compare tidal conditions at and near an inlet along Florida's Atlantic coast. Supportive hydrographic and surface atmospheric pressure data were incorporated to estimate the probable maximum errors in comparing pressure fluctuations with water level variations. The M sub 2 tidal amplitude decreases from 0.45 decibar (0.45 m + or - 0.02 m) over the inner shelf to 0.28 m in the nearby inlet. There is an 11 deg phase lag of the M sub 2 tide in the inlet. The K sub 1 and O sub 1 constituent amplitudes show essentially no decrease from the shelf to the inlet, though the tidal wave form is delayed by 9 deg and 18 deg, respectively. Locally damped amplitudes and phase lags are attributed to estuarine-shelf exchanges through the inlet. Local perturbations in the tidal harmonic constants may have a significant effect on the construction of co-tidal and co-range charts for the adjacent ocean basin. (Humphreys-ISWS)
W80-05816

SHALLOW WATER SURFACE WAVE ELEVATION DISTRIBUTIONS,
Coastal Engineering Research Center, Fort Belvoir, VA.
E. F. Thompson.
Journal of the Waterway, Port, Coastal and Ocean Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WW2, Technical Note, p 285-289, May 1980. 2 Fig, 2 Tab, 7 Ref, 1 Append.

Descriptors: *Wave(Water), *Shallow water, *Coasts, *Water levels, On-site data collections, Analytical techniques, Analysis, Statistical methods, Skewness, Kurtosis.

Skewness and kurtosis of the sea surface elevation distribution were investigated at six shallow water staff gage locations along U.S. coasts. Both skewness and kurtosis tended to be greater than zero. High wave conditions were associated with high skewness values at all six loations. High skewness values are indicative of nonsinusoidal wave profiles which, when analyzed by Fourier transfom techniques can result in nonindependent spectral peaks in addition to the main spectral peak. Since the highest values and thus the most prominent nonindependent spectral peaks tend to be associated with wave conditions with the highest significant heights, these characteristics must be considered in any careful attempt to simulate high energy spectra in shallow water. (Humphreys-ISWS)
W80-05824

FRICTION FACTORS IN STORM SURGES OVER INLAND AREAS,
Water Resources Engineers, Springfield, VA.
R. Walton, and B. A. Christensen.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 106, No WW2, Proceedings Paper 15439, p 261-271, May 1980. 5 Fig, 1 Tab, 20 Ref, 2 Append.

Descriptors: *Coastal plains, *Flooding, *Friction, *Florida, Hurricanes, Hydraulics, Storm surges, Model studies, Flow, Storms, Darcy-Weisbach equation, Mathematical studies, *Friction coefficient, Bottom friction.

In many recent models of hurricane-generated surges, a quadratic law is used to describe the bed friction. When models include overland flooding, friction factor values throughout the solution domain often reflect ocean bed conditions. A theory was presented to develop model friction factors based on a Darcy-Weisbach type relationship that gives the coefficients spatial variability, dependent on bed roughness, obstructions and their spacings, and local depths. An equivalent friction factor was introduced which combines overland values, derived by considering and assumed prevailing logarithmic velocity distribution, with values derived by considering the theoretical form of the head loss due to drag froces acting on uniformly distributed obstacles. The effects of the equivalent friction factor were studied for hurricane-generated surges on the west coast of Florida. It was shown that its introduction, based on natural vegetation and man-made obstructions, attenuated and lagged the peak surge at the project site, compared with surges simulated using a uniform value based on the ocean bed. (Lee-ISWS)
W80-05825

WAVE RUNUP ON VARIABLE BEACH PROFILES,
Tetra Tech, Inc., Jacksonville, FL.
R. B. Taylor, E. Ozsoy, and T. J. Turco.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 106, No WW2, Proceedings Paper 15424, p 169-182, May 1980. 6 Fig, 16 Ref, 2 Append.

Descriptors: *Beaches, *Coastal engineering, *Profiles, Surges, Wave pile-up, Waves(Water), Hydraulics, Slopes, Geomorphology, Mathematical studies, *Beach profiles, Wave runup.

The runup of breaking waves on beach profiles of variable slope was analyzed as a function of beach and offshore profile geometry, variations in stillwater level, and wave characteristics. The representation of composite beach and offshore slopes approximates the profile geometry as a parabolic curve that provides a continuous, smooth representation of the profile geometry and simplifies the calculation of composite slope values. For concave, upward profile geometries with fixed values of wave period and stillwater elevation, the runnup was observed to first increase, reach a maximum, and then decrease as the deepwater wave height is increased. Increases in the stillwater level produce higher values of wave runup for fixed wave height and period. For linear profile geometries, the runup was observed to increase continuously with increasing wave height, independently of changes in the stillwater elevation. (Lee-ISWS)
W80-05826

IN SITU DETERMINATION OF SUSPENDED PARTICULATE MATTER AND DISSOLVED ORGANIC MATTER CONCENTRATIONS IN AN ESTUARINE ENVIRONMENT BY MEANS OF AN OPTICAL BEAM ATTENUANCE METER,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Geoscience Centre.
G. V. Winters, and D. E. Buckley.
Estuarine and Coastal Marine Science, Vol 10, No 4, p 455-466, April 1980. 9 Fig, 2 Tab, 15 Ref.

Descriptors: *Estuarine environment, *On-site tests, *Suspended solids, *Organic matter, Estuaries, Testing procedures, Instrumentation, Spectrometers, Optical properties, Laboratory tests, Water properties, Sampling, Water quality, Analytical techniques, Analysis, Salinity, Humic acids, Kaolinite, Attenuation, Absorption, Data collections.

An optical technique was developed for the in situ estimation of estuarine suspended particulate matter (SPM) and dissolved organic matter (DOM) concentrations in water. Measurements were made in the laboratory and the field, and attenuance coefficients were determined at wavelength bands centered at 475 nm and at 680 nm. Laboratory measurement of attenuance caused by kaolinite suspensions and humic acid solutions were used to determine the wavelength selectivity or the 475 nm/680 nm band ratio for SPM and DOM. The light attenuated by kaolinite suspensions and SPM was attributed to both absorbance and scattering, but for dissolved humic acid it was attributed only to absorbance. The optical band attenuance ratio was constant for each type of substance. Mathematical expressions, applicable to complex aqueous mixtures, were formulated to differentiate between changes in attenuance coefficients resulting from: (1) concentration variations of kaolinite suspensions or SPM and (2) dissolved humic acid or DOM. (Humphreys-ISWS)
W80-05849

TIDAL INDUCED REGULATION OF NITROGEN FIXATION ACTIVITY (C2H4 PRODUCTION) IN A GEORGIA SALT MARSH,
Cedar Crest Coll., Allentown, PA. Dept. of Biology.
M. S. Ubben, and R. B. Hanson.
Estuarine and Coastal Marine Science, Vol 10, No 4, p 445-453, April 1980. 7 Fig, 1 Tab, 23 Ref. NSF OCE75-20847.

Descriptors: *Salt marshes, *Tidal effects, *Georgia, *Nitrogen fixation, Water quality, Tidal marsh, On-site investigations, Salinity, Spatial distribution, Chlorides, On-site data collections, Marsh plants, Tidal flushing, Acetylene reduction.

Nitrogen fixation potential, determined by the acetylene reduction technique, was measured at 14 sites across a Georgia salt marsh. The transect spanned: (1) tall and short Spartina alterniflora and natural funcus and Salicornia monocultures, and (2) small tidal creek which usually floods over a levee into a short Spartina marsh during high tides. Spring tides usually flood the entire marsh and enter the Funcus zone. Nitrogen fixation potential in the soil was related to sites of daily tidal inundation and not to interstitial salinity. The authors also artificially altered the salinity in cores from short and tall Spartina zones to investigate whether nitrogen-fixing populations were tolerant to fluctuations in salt concentration. Results indicated that populations in the marsh are diverse and fluctuate monthly with respect to salinity tolerance in Sapelo Island salt marsh soils. (Humphreys-ISWS)
W80-05850

THE STUDY OF A NATURAL HYPERSALINE LAGOON IN A DESERT AREA (THE BARDAWIL LAGOON IN NORTHERN SINAI),
Israel Oceanographic and Limnological Research Inst., Haifa. Dept. of Chemistry.
B. S. Krumgalz, H. Hornung, and O. H. Oren.
Estuarine and Coastal Marine Science, Vol 10, No 4, p 403-415, April 1980. 4 Fig, 3 Tab, 68 Ref.

Descriptors: *Lagoons, *Water quality, *Brines, *Deserts, Laboratory tests, On-site investigations, Sampling, Data collections, Evaporation, Chemical precipitation, Analysis, Hydrogen ion concentration, Magnesium, Salinity, Calcium, Ions, Water temperature, Nutrients, Phosphorus, Nitrogen, Silica, Dissolved oxygen, Foreign research, *Israel, *Bardawil Lagoon, Hypersaline lagoons.

The hypersaline Bardawil Lagoon, situated on the Mediterranean coast of the Sinai Peninsula, was studied. Seven environmental parameters (water temperature, salinity, pH, calcium and magnesium ion concentrations, content of dissolved oxygen and micro-nutrients) were monitored. The magnesium/salinity and calcium/salinity ratios of the brines of the Bardawil Lagoon (0.0387 + or - 0.0002 and 0.0114 + or - 0.0002 g/l(S%), respectively) are equal to the ratios for Mediterranean seawater and are in good agreement with literature values for other oceans and seas. The process of the formation of the Bardawil Lagoon water body was modeled in laboratory conditions by evaporation of seawater during some months. The results of this study, the constancy of the magnesium/salinity and calcium/salinity ratios and their identical values to those of Mediterranean seawater, show that the brines of the Bardawil Lagoon were formed by mere evaporation of Mediterranean seawater without the interference of other nonmarine water sources except rainwater. (Humphreys-ISWS)
W80-05851

WATER QUALITY ANALYSIS OF THE HALIFAX RIVER, FLORIDA,
CH2M HILL, Inc., Gainesville, FL.
For primary bibliographic entry see Field 5B.
W80-05856

A SUGGESTION FOR ANTICIPATING ALTERATIONS IN WAVE ACTION ON SHORES CONSEQUENT UPON CHANGES IN WATER DEPTHS IN HARBORS AND COASTAL WATERS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
B. Kinsman, J. R. Schubel, G. E. Carroll, and M. Glackin-Sundell.
Special Report 27, Reference 79-10, July 1979. 43 p, 37 Fig, 13 Tab, 1 Ref, 1 Append.

Descriptors: *Waves(Water), *Computer models, *Beach erosion, *Energy, *Simulation analysis, Bathymetry, Depth, Dredging, Turbulence, Shore protection, Coastal engineering, Data storage and retrieval, Harbors, *New York Harbor.

A computer program designed for the calculation and plotting of surface wave rays in the Lower Bay of New York Harbor is reported. The data indicate which parts of the coast are susceptible to natural erosion and erosion caused by dredging. Six different waves were selected for ray tracing in order to give the wave energy along the coast of the Lower Bay. The bathymetry of the Lower Bay was stored in a computer and for convenience, the area was sectionalized in grids of 0.1 nautical mile and the water depths were digitized. Dredged channels resulted in a loss of information because they represented aborted rays. The heaviest wave attacks were found on the seaward faces of Sandy Hook and Rockaway Point. Surprisingly, selected dredging to 90 feet would increase the wave energy on the seaward face of Sandy Hook by 8.3%. Other areas of heavy wave attack are Coney Island and a strip from Hugenot Beach to Midland Beach on Staten Island. These are already known areas of heavy wave activity, so the computer simulation works well. Shifts in wave intensities can be brought about by selected dredging. Dredging followed by backfilling with unwanted fine-grained dredged material may prevent increased wave action. Computer simulation of coastal wave erosion will help in the issuance of dredging permits. (Sidney-IPA)
W80-05864

OCEAN OUTFALL DILUTION: EFFECTS OF CURRENT,
Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-05952

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

PHYSICAL CHARACTERISTICS OF SOME MINESOILS,
Pennsylvania State Univ., University Park. Dept. of Agronomy
T. A. Pedersen, A. S. Rogowski, and R. Pennock, Jr.
Soil Science Society of America Journal, Vol 44, No 2, p 321-328, March-April 1980. 5 Fig, 9 Tab, 29 Ref. EPA-LAG-D5-E763.

Descriptors: *Coal mine wastes, *Strip mine wates, *Physical properties, *Hydraulic properties, *Pennesylvania, *Land reclamation, Strip mines, Spoil banks, Bulk density, Evapotranspiration, Infiltration, Hydraulic conductivity, Soil profiles, Coal mines, Appalachian Mountain Region, Lysimeters, On-site investigations, Minesoils, Water retention.

Studies were conducted to evaluate physical properties of spoils resulting from surface-coal mining and reclamation operations in Clearfield County, Pennsylvania. Bulk density, evapotranspiration, water retention, infilration, and hydraulic conductivity values were determined at ten sites randomly located within a 4-ha experimental area. Average bulk density of the surface 0.5-m layer of minesoil was 1763 kg/cu m, while specific surface at most sites averaged 31 sq m/g. Microlysimeter data indicated that evapotranspiration (ET) on minesoil could be approximated by class-A pan evaporation or by model results. A large amount of spatial variation was observed in infiltration, water retention, and hydraulic conductivity values. In the uppermost 0.75 m of the profile most minesoils on the average retained 35 mm of water, between 10 and 1500 kPa, compared to 136 mm for the adjoining soils. When water was available ET approached potential; however, hydraulic properties of the minesoil would likely lead to droughty conditions and extended periods of plant stress. (Visocky-ISWS)
W80-05955

HEAT-POWERED WATER PUMP,
Utah State Univ. Foundation, Logan. (Assignee).
D. G. Chadwick.
U.S. Patent No 4,177,020, 6 p, 1 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 213, December 4, 1979.

Descriptors: *Patents, *Heat pumps, *Water delivery, Puming, Solar radiation, Flash distillation, Irrigation, Temperature, Thermal power, Water pumps.

A heat-powered water pump is provided which can utilize either solar energy or thermal energy from burning agricultural wastes. The heat-powered water pump is especially suitable for pumping water at a remote location and from a relatively shallow location to an elevated location. The pump includes a pumping chamber with an expandable pumping member, a flash boiler and a condensate metering device for automatically metering a predetermined quantity of condensate to the hot surface of the flash boiler. The vapor generated by the flash boiler expands the flexible pumping member thereby displacing water from the pumping chamber. The surface of the pumping member also serves as a heat transfer surface between the hot vapor and the surrounding water in the pumping chamber to condense the vapor. The condensate collects in a condensate reservoir and is directed into the metering device by a valve operated by the pumping member. The pump is self-starting and requires minimal monitoring. (Sinha - OEIS)
W80-05966

3C. Use Of Water Of Impaired Quality

IRRADIANCE, TEMPERATURE, AND SALINITY EFFECTS ON GROWTH, LEAF ANATOMY, AND PHOTOSYNTHESIS OF DISTICHLIS SPICATA (L.) GREENE,
New Mexico State Univ., Las Cruces. Dept. of Biology.
P. R. Kemp, and G. L. Cunningham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-200082, Price codes: A03 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State Univ. Report No 121, April 1980. 32 p, 8 Fig, 6 Tab, 31 Ref. OWRT B-058-NMEX(1), 14-34-0001-8101.

Descriptors: *Light intensity, *Salinity, *Temperature, Photosynthesis, Respiration, *Salt tolerance, *Growth rates, *Plant growth, Stomata, Leaves.

The effects of irradiance, temperature, and salinity on growth, net CO2 exchange, and leaf anatomy of Distichlis spicata were investigated in controlled environment chambers. When plants were grown at low irradiance, growth rates were significantly reduced by high substrate salinity or low temperature. However, when plants were grown at high irradiance, growth rates were not significantly affected by temperature or salinity. The capacity for high irradiance to overcome depressed growth at high salinity cannot be explained completely by rates of net photosynthesis, since high salinity caused decreases in net photosynthesis at all environmental conditions. This salinity-induced decrease in net photosynthesis was caused largely by stomatal closure, although plants grown at low temperature and low irradiance showed significant increases in internal leaf resistance to CO2 exchange. Increases salinity resulted in generally thicker leaves with lower stomatal density but no significant differences in the ratio of mesophyll cell surface area to leaf area. Salinity and irradiance during growth did not affect rates of dark respiration. The mechanisms by which Distichlis spicata tolerates salt appear to be closely coupled to the utilization of light energy. Salt-induced leaf succulence is of questionable importance to gas exchange at high salinity in this C4 species.
W80-05798

3D. Conservation In Domestic and Municipal Use

THE WATER ECONOMY OF A LOW FLUSH TOILET IN A WATER DEFICIENT REGION,
Caribbean Research Inst., St. Thomas. Water Resources Research Center.
A. E. Pratt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-199672, Price codes: A02 in paper copy, A01 in microfiche. Technical Report No 3, July 1979, 19p, 1 Fig, 7 Tab, 6 Ref, 1 Append. OWRT A-004-VI(1), 14-34-7100.

Descriptors: *Water conservation, *Low flush toilets, Virgin Islands, Evaluation, Water quality, Costs.

Water use at a public restroom facility was substantially reduced after installation of low-flush toilets. Water in the region is scarce, demand is high, and water is expensive. The first year of operation of the low-flush toilets saved 36,500 gallons and reduced the true cost of water used at the facility, predominantly desalted water, from $757 to $210. The research demonstrated the practical value of a conservation technique that, if widely used in the Territory, could substantially reduced costs for government water and energy production.
W80-05800

DEPTH/FLOW MONITORING INSTRUMENTATION,
Pro-Tech, Inc., Paoli, PA. (Assignee).
C. L. McClure.
U.S. Patent No 4,176,550, 5 p, 4 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 52, December 4, 1979.

Descriptors: *Patents, *Monitoring, *Instrumentation, *Flow, Measurement, Bubble gages, Water level recorders, Conduits.

A pressure-responsive instrument such as an indicator or recorder is used with a bubbler type of sensing probe for monitoring liquid depth or flow in a sewer pipe or the like. The instrument housing contains means for regulating the rate of bubble release to the probe and also contains means regulating the rate of bubble release to the probe and also contains means for diverting the bubble release temporarily to an adjacent bubble rate test location. The same housing also carries a manifold for supporting bubble fluid containers and means for regulating the resulting bubble fluid pressure in the manifold, for connection to the probe. (Sinha - OEIS)
W80-05960

3F. Conservation In Agriculture

MEANS FOR CONVERTING A WATER DRIVE CENTER PIVOT IRRIGATION SYSTEM TO AIR DRIVE,
L. R. Townsend.
U.S. Patent No 4,176,676, 10 p, 6 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 95 December 4, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, Irrigation practices, Irrigation operation and maintenance, Irrigation efficiency, Application equipment, Air pressure drive systems.

A method and means for converting a water drive center pivot irrigation system to air drive is described whereby the more economical air drive is substituted for the water drive on each of the drive towers. The water drive cylinder on each of the drive towers of the system is modified to function as an air cylinder which is connected to the trojan bar on the drive tower whereby actuation of the air cylinder will cause the trojan bar to be reciprocally moved to drive at least one of the drive wheels on the tower. An alignment panel is mounted on the drive tower and is connected to the air cylinder for controlling the operation. The alignment panel is secured to the existing alignment control apparatus on the drive tower so that the alignment panel will function in response to the alignment control apparatus. An air compressor is placed at the well site and is connected to each of the alignment panels and to the drive cylinder on the lead tower for supplying air under pressure. (Sinha - OEIS)
W80-05961

AUTOMATICALLY CONTROLLED IRRIGATION SYSTEM,
FIAT S.P.A., Turin (Italy). (Assignee).
M. Cattaneo, and R. Masoero.
U.S. Patent No 4,176,791, 7 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 135-136, December 4, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, Irrigation operation and maintenance, Irrigation efficiency, Application equipment, Automatic control, Valves, Nozzles.

An irrigation system of the type comprising a number of nozzles spaced along a pipeline are fed at one end from a source of supply of irrigation liquid, which may be purely water or may be water with additives. In order to avoid different spray rates due to a loss in pressure along the pipeline, each nozzle is provided with a valve and an associated resilient subsidiary reservoir. The valves operate to close off the nozzles while all the subsidiary reservoirs charge up to the line pressure and then, when a control valve diverts the source of supply to a discharge outlet all the nozzles receive liquid in the same pressure from their associated subsidiary reservoir. When the subsidiary reservoirs are all back at atmospheric pressure the cycle recommences. (Sinha - OEIS)
W80-05964

HEAT-POWERED WATER PUMP,
Utah State Univ. Foundation, Logan. (Assignee).
For primary bibliographic entry see Field 3B.
W80-05966

ROTARY IRRIGATION SPRINKLER,
Rain Bird Sprinkler Mfg. Corp., Glendora, CA. (Assignee).
W. J. Wichman.
U.S. Patent No 4,177,944, 5 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 989, No 2, p 519-520, December 11, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Application equipment, Irrigation efficiency, Irrigation operation and maintenance.

A simplified irrigation sprinkler construction which substantially reduces the cost of manufacturing such sprinklers is described. The sprinkler construction is trouble-free and reliable in use, and attains its improved characteristics without requiring a bearing mounted oscillating arm or a relatively weak and easily damaged coil spring. The sprinkler includes a water deflector for imparting rotational movement to the sprinkler, the deflector being mounted on one end of an elongated spring wihch is secured at its other end to the body of the sprinkler. The spring is rigidly mounted on the sprinkler body, biases the deflector into the stream of water ejected from the sprinkler, and provides the sole means of support of the deflector on the sprinkler. By this arrangement no frictionally wearing bearing is required. (Sinha - OEIS)
W80-05973

INTEGRAL DRIP IRRIGATION SYSTEM,
J. Sahagun-Barragan.
U.S. Patent No 4,177,946, 12 p, 13 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 989, No 2, p 520, December 11, 1979.

Descriptors: *Patents, *Irrigation systems, *Irrigation practices, Application equipment, Irrigation efficiency, Irrigation operation and maintenence, Filtration, Drip irrigation.

An integral drip irrigation system comprises an elongated laminate which forms an integral part of a pipe for carrying irrigation water and is constituted by a plastic flexible sheet, thermally deformed to provide at least one winding channel running along it. The system having pressure dissipating passages will solve the problems of the prior systems consisting of clogging of the passages by entrance of foreign matter and variation of the emitted flow of water. The system contains a filtration system for the water prior to the entrance to the pressure dissipating passages. The design provides for admission zones at the top of the pipe circumference in order to avoid entrance of foreign matter and the emitter zones are arranged at the bottom of the circumference of the pipe for discharging water downwardly. (Sinha - OEIS)
W80-05974

IRRIGATION DEVICE,
S. W. O. Menzel.
U.S. Patent No. 4,177,947, 4 p, 6 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 989, No 2, p 520-521, December 11, 1979.

Descriptors: *Patents, *Irrigation, *Sprinker irrigation, Irrigation efficiency, Application equipment, Flow control, *Drip irrigation.

The invention combines in one device such features as: mist spraying, drip irrigation, and cleaning. The device with variable control is arranged to give either a drip feed through an elongated helical channel or a sprinkler feed through a direct outlet to the sprinkler and acts as a valve to shut off flow by turning a key within the body to locate relevant passages. (Sinha-OEIS)
W80-05975

THE BOOM IN IRRIGATION,
B. Butterworth.
Farmer's Weekly, Mobeni Natal p 42-45. January 11, 1978.

Descriptors: *Irrigation systems, *Sprinkler irrigation *Europe, Labor, Mechanial equipment, Drops(Fluids), Irrigation efficiency, Hoses, Irrigation, Surface irrigation, Water delivery, Irrigation operation and maintenance, Water distribution(Applied).

Irrigation techniques in Europe have recently moved away from labor and toward rain guns. Changes are also being seen in the type of applicator used. Sprinkler type applicators produce much smaller water droplets than do rain guns. Smaller

droplet size is important on soils that cap easily, especially when these soil surfaces are bare. Large boom-type irrigators with sprinklers are being over-shadowed by reel-type machines with rain guns. Wright Rains's Laureau Rotating Boom features sprinklers and a stationary carriage. It produces a circular wetted pattern with good droplet size. The Rainmatic System, another new irrigator, is self-propelled with a water-driven piston winching the machine along on an anchored cable. The supply hose is wound up on the drum as the machines moves. Farrow is producting a line of small mobile guns that haul themselves over the field. However, the machine does produce large droplets and a 'loop carrier' is needed to prevent damage caused by the loop dragging over row crops. Other similar drum type units are being produced that leave the main part of the machinery on the headland and move only the gun itself. Another innovation that has been introduced is the Ardleigh Swift Rainmaster, a machine that can spread slurry as well as water. Many of the new reel-type guns sharply reduce labor requirements, however, they do sacrifice the small droplet size produced by the sprinkler-type boom irrigators. (Seigler-IPA)
W80-05986

A COMPARISON OF DIFFERENT METHODS TO INCREASE PRODUCTIVITY OF NAVEL TREES,
Zebediela Citrus (Pty) Ltd. (South Africa).
P. S. Fouche, D. H. Bester, and G. H. Veldman.
The Citrus and Subtropical Fruit Journal No 542, p 406, January 1979. 4 Tab, 2 Ref.

Descriptors: *Irrigation systems, *Irrigation efficiency, *Crop production, Crop response, Water requirements, Sprinkler irrigation, Water utilization, Soil moisture, Evapotranspiration, Water spreading, Moisture stress, Moisture availability, South Africa, Fruit crops.

A field experiment with Navel trees was used to compare water usage, tree performance, and cropping of trees for four types of irrigation. The irrigation methods compared were drip, microjet, dragline sprinklers, and open hose. For the experiment, 224, 22-year-old Navel trees were used. Trees were planted in 6.2 by 6.5 m square patterns. A 14 day period was used for comparison of methods. Consumptions during this period was used for comparison of methods. Consumptions during this period were: first drip treatment -- 840 liters, second drip treatment -- 1,260 liters, microjet -- 1,350 liters, open hose -- 1,800 liters, and dragline sprinklers -- 2,640 liters. Fertilizer was added based on leaf analysis. At harvest time, yield and fruit data were collected. Results show that the highest yield values were produced by the dragline sprinklers, however, good yields were also produced by the microjet and drip treatment which used 50 less water. A determination of yield from unit volume water used shows that sprinkler irrigation produced the lowest yield per unit volume of water used, while drip produced the highest. Microjets compared favorably with drip in yield per unit volume of water used. Improved fruit quality was produced by using microjet irrigation at 5 day intervals. It is concluded that microjet irrigation is very efficient under limited water supply conditions, however, for this method, a determination of the available soil moisture in different soils at optimum root depth is required. (Seigler-IPA)
W80-05987

IRRIGATION OF BANANAS (BESPROEIING VAN PIESANGS),
Citrus and Subtropical Fruit Inst., Nelspruit (South Africa).
G. S. Bredell, F. A. Kuhne, J. D. DuPlessis, and P. Van Zyl.
The Citrus and Subtropical Fruit Journal, No 538, p 19-22, September 1978, 3 Fig, 5 Tab, 9 Ref.

Descriptors: *Water requirements, *Crop production, *Irrigation design, Crop response, Photoperiodism, Cloud cover, Irrigation efficiency, Orchards, Spraying, Productivity, Plant growth, Moisture availability, Fruit crops, Agriculture.

The water requirements of bananas and the factors influencing these requirements are reviewed. Banana need from 1000 to 4000 mm of rainfall per year. Also, this rainfall is needed within short intervals as prolonged dry periods reduce fruit production. Where rainfall is insufficient or irregular, irrigation is needed for the production of high yields. A major factor effecting banana water requirements is the number of hours of sunshine per day. On a sunny day the plants may require up to 5 mm per day, while on an overcast day this requirement may drop to les than 2 mm. (Seigler-IPA)
W80-05988

A BRANK-NEW IRRIGATION SYSTEM (SPLINTERNUWEBESPROEIINGSTELSEL),
A. Gouws.
Landbouweekblad, No 3, p 10-12. January 20, 1978, 5 Fig.

Descriptors: *Irrigation systems, *Irrigation efficiency, *Sugarcane, *Citrus fruits, Underground structures, Spraying, Water distribution(Applied), Labor, Piping systemsl(Mechanical), Operating costs, Water pressure, Nozzles, Farm equipmentl, Lateral conveyance structures.

A labor saving, water saving irrigation system for sugarcane and citrus was successfully tested. The system has a main header pipe with laterals, all laid permanently underground. Spray nozzles are mounted on the underground pipe system. (Seigler-IPA)
W80-05991

GROWING VEGETABLES ON THE SEA: AN EXPERIMENTAL INVESTIGATION,
D. L. Milne.
The Citrus and Subtropical Fruit Journal, No 539, p 11 and 15, Octobetr 1978, 5 Fig.

Descriptors: *Salt tolerance, *Sea water, *Water requirements, *Condensation, Salinity, Vegetable crops, Agriculture, Crop response, Irrigation systems, Moisture stress, Moisture uptake, Evaporation, Water vapor, Water harvesting.

The common garden beet, Beta vulgaris L, was successfully grown on prototype floating rafts using condensation and conservation to provide the water required for growth. Floating vegetable beds show potential as a means of utilizing evaporation and rainfall on the ocean for the prouction of food. The beet was used as a test plant due to its high salt-tolerance level. Prototype rafts were made of expanded polystyrene. Plastic gauze was used as a base for the growing medium because its porosity allows for drainage as well as the passage of rising water vapor from the water surface. A 50:50 mixture of peatmoss and Kraal manure was used as a growing medium. A black 'interleaf appletray' formed the top layer allowing for accumulation of precipitation and condensation water in the zone of the plant roots. A prototype raft seeded and placed outdoors in a tank of fresh water with temperatures between 20 and 30C, produced mature beets when the recorded rainfall for the growth period was only 25.7 mm. A second test was made with seawater and raft temperatures of 14 to 20C. These beets grew for 42 days without supplementary irrigation before signs of water stress developed. In both tests, control seedlings grown indoors in open pots died of drought in a week. Results show the potential for future developments utilizing the oceans for agriculture. (Seigler-IPA)
W80-05993

ASPHALT-CHANNEL PREVENTS BRACKISHNESS (ASPHALT-KANALEBVOORKOM BRAK),
P. C. Minnaar.
Landouweekblad, No 3, 4 Fig, January 20, 1978. p 56-57.

Descriptors: *Canal linings, *Irrigation canals, *Water conveyance, *Asphalt, *Brackish water, Soil conservation, Water conservation, Irrigation water, Salinity, Saline soils Percolation, Linings, Construction materials, *South Africa.

Irrigation canals can be improved by the use of modern machines that line the canals with asphalt. Weed control in the canals is provided by herbicides in the asphalt. Lining irrigation canals with asphalt prevents leakage of the water and thus is a means of water conservation. The asphalt linings also promote soil conservation by preventing brackishness of the soil. (Seigler-IPA)
W80-06000

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

LINEAR RESERVOIRS AND NUMERICAL DIFFUSION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Proceedings Paper 15393, p 691-699, May 1980. 2 Fig, 11 Ref, 2 Append.

Descriptors: *Reservoirs, *Routing, *Runoff, *Model studies, Mathematical models, Watersheds(Basins), Diffusion, Numerical analysis, Surface runoff, Streamflow, Hydrographs, Discharge(Water), Hydrology, Linear reservoirs.

The conceptual model of a cascade of linear reservoirs, in particular the SSAR routing equation, was reviewed in the light of the theory of numerical diffusion. The SSAR routing equation is a special case of the Muskingum routing equation. Since the latter simulates the diffusion processes by 'off-centering' the temporal derivative in its discrete formulation, it follows that the same numerical diffusion mechanism underlies the SSAR routing equation and its associated linear reservoir assumption. The extension of the technique to a cascade of linear reservoirs, thus providing an additional parameter for simulation purposes, is readily envisaged. The use of a conceptual model such as the cascade of linear reservoirs remains a problem of system identification: given an excitation (excess rainfall) and system response (basin outflow), the overall system characteristics (model parameters) are sought by calibration. (Sims-ISWS)
W80-05846

FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION--HEC-1 CAPABILITY.
Hydrologic Engineering Center, Davis, CA.
Training Document No 9, October 1974 (Revised September 1977). 199 p 3 Fig, 6 Ref, 1 Append, 7 Exhibits.

Descriptors: *Flood control, *Systems analysis, *Hydrologic systems, *Model studies, Computer models, Analytical techniques, Analysis, Computer programs, Reservoirs, Diversion, Storage, Pumping plants, Economics, Hydrographs, Training, HEC-1.

This document presented detailed illustrated examplS of facility optimization using HEC-1. The examples were designed to assist in data assembly and coding, output interpretation, and study management. Examples included were constructed in building block sequence to illustrate the relationships between the hydrologic, economic, and cost data and to demonstrate selected capability. Examples illustrated include: (1) hydrologic model for existing conditions; (2) economic evaluation of existing conditions; (3) optimization of reservoir and pumping plant with no hydrologic constraints; (4) optimization of reservoir and pumping plant with hydrologic performance constraints; (5) optimization of reservoir, pumping plant, and diversion (unconstrained); (6) optimization of local protection projects, levee and channel modification (unconstrained); (7) optimization of reservoir, pumping plant, and local protection projects with uni-

form local protection level. The optimization algorithm (or search procedure) discussed was developed to assist the planner in systematically and efficiently screening a large number of possible flood control alternatives. It should be emphasized that the optimization procedure of HEC-1 is a planning tool for determining potential and economically feasible flood control alternatives. Once those that have potential are selected, a more detailed simulation of the operational and hydraulic characteristics of a particular component will probably be required as various stages of study (leading to design) are undertaken. (Humphreys-ISWS)
W80-05926

APPLICATION OF THE HEC-5 HYDROPOWER ROUTINES,
Hydrologic Engineering Center, Davis, CA.
V. R. Bonner.
Training Document No 12, March 1980. 48 p, 1 Fig, 9 Ref.

Descriptors: *Hydroelectric power, *Systems analysis, *Computer programs, *Reservoirs, Training, Reservoir operation, Flood routing, Storage, Reservoir yield, Flood damage, Economics, Evaporation, Discharge(Water), Reservoir releases, Pumped storage, Optimization, Project planning, HEC-5, Data requirements.

This training document was written to assist users of computer program HEC-5, Simulation of Flood Control and Conservation Systems, in hydropower applications. This document supplements the program Users Manual, which is the basic documentation for the program. The chapters on hydropower application describe the data requirements, program operation, and program output for the HEC-5 hydropower routines. The Users Manual, available from the Hydrologic Engineering Center, provides the input specifications. The conceptual model of a reservoir system is a branching network with a reservoir at the start of every branch. The reservoirs and nonreservoir control points are linked to each other by routing criteria. The whole system cascades downstream and converges to a final control point. Reservoirs and control points are the only locations where flows, constraints, and demands are evaluated by the program. Diversions may be used to route flows to other locations in or out of the basin. The Center maintains a complete library of its programs at the government-owned Lawrence Berkeley Laboratory computer at Berkeley, California, and Boeing Computer Service at Seattle, Washington. (Humphreys-ISWS)
W80-05927

PHYSICAL CHARACTERISTICS OF SOME MINESOILS,
Pennsylvania State Univ., University Park. Dept. of Agronomy
For primary bibliographic entry see Field 3B.
W80-05955

AQUATIC PLANT SAMPLER,
T. G. Kelpin.
U.S. Patent No 4,177,624, 11 p, 16 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 989, No 2, p 413, December 11, 1979.

Descriptors: *Patents, *Aquatic plants, *Sampling, Aquatic weed control, Bottom sampling, Boats, Barges, Bodies of water.

An aquatic plant sampler includes an aquatic craft characterized by pontoons secured to a flat deck member and propelled and steered by a dual power system. It includes an above water air propulsion system and an underwater, inboard, outboard or in-board-outboard propulsion system. The aquatic plant sampler is further characterized by a sampling bucket fitted with a chain driven cutter system. The bucket is capable of being lowered through a hole provided in the center of the barge to collect aquatic plant specimens and water bottom samples for analysis with a view toward controlling such aquatic vegetation in lakes, rivers and reservoirs. (Sinha - OEIS)
W80-05972

FUTURE TREATMENT PLANT REQUIREMENTS,
Durban Municipality (South Africa).
D. C. Macleod.
IMIESA (Johannesburg), Vol 1, No 9, p 23, 25, 1976.

Descriptors: *Water supply, *Water shortage, *Water supply development, Dams, Precipitation, Land use, Irrigation, Impoundments, Water reuse, Water distribution(Applied), Public utilities, Industrial plants, Nuclear power plants, Desalination, Eutrophication, Waste water treatment, Evaporation, Evapotranspiration, *South Africa.

South African water requirements are expected to rise so that there will be a shortage by the year 2000 unless new water sources can be found. An increase in precipitation, land usage and storage techniques, or dam programs could make up the difference, but the distribution of the water remains the major problem. The regions of greatest water requirement are not always located in an area of adequate supply and problems will probably develop in the Durban-Pietermaritzburg, Western Cape, and Port Elizabeth-Uitenhage regions. Two-thirds of the power generation in the future will be provided by inland nuclear power stations where cooling water recycling will be critical. The extent of reuse of effluent will depend on the ability of waste water treatment plants to remove chemicals and heavy metals from the water. Treatment of euthrophicated water remains expensive when compared to the treatment of unpolluted impoundment water. Desalination is economically feasible if there is an energy source nearby. It was concluded that industrial development would depend largely on water availability, power generation afforded by coastal nuclear power stations, and effluent reuse which requires technological expertise. (Sidney-IPA)
W80-05977

4B. Groundwater Management

GROUND-WATER MANAGEMENT IN THE HIGH PLAINS,
Oklahoma Water Resources Board, Oklahoma City, Planning Div.
G. Wickersham.
Ground Water, Vol 18, No 3, p 286-290, May-June 1980. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Groundwater, *Management, *Aquifer management, *Great Plains, *Water management(Applied), Pumping, Well regulations, Aquifers, Water resources, Water users, Irrigation, Wells, Water wells, Hydrogeology, *High Plains.

The High Plains region of mid-America depends on groundwater to a huge extent. A review of three states--Texas, Colorado, and Oklahoma--shows a disparity in groundwater management in the region. Texas landowners own the groundwater as a property right, and the emphasis is on local management districts to control groundwater use. Colorado, in contrast, has state control of groundwater and regulation by permit from the state engineer. Oklahoma is unique in tightly regulating groundwater through limitations on pumpage, while still adhering to ownership by the individual landowner. In spite of these differences, six of the High Plains states have united in a joint effort to study the groundwater in the Ogallala. A $6 million study funded by Economic Development Administration will evaluate the economic impacts of groundwater mining and determine future water resources management in the region. (Sims-ISWS)
W80-05743

SEQUENTIAL USE OF RECLAIMED WASTEWATER DESTINED FOR AQUIFER RECHARGE,
Caribbean Research Inst., St. Thomas. Water Resources Research Center.
H. H. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-199680, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No 4, June 1979. 23p, 10 Fig, 6 Tab, 7 Ref. OWRT A-001-VI(1), 14-34-7100.

Descriptors: *Artificial recharge, *Wastewater, *Irrigation, *Water reuse, *Water spreading, Advanced wastewater treatment, Virgin Islands, Aquifer management.

Effluent from the advanced wastewater treatment plant in St. Croix, U.S. Virgin Islands, a water-deficient island, was used to recharge aquifers by use of spreading basins. Wells in the recharge area were monitored to determine changes in static levels and in quality. Results indicate an increase in the quantity of water in the aquifer and an upgrading in the quality of the effluent. An economic analysis showed the cost of recharge/recovery operations to be significantly less than the cost of desalination of sea water which supplies the major portion of water to the island.
W80-05801

AVAILABILITY OF FRESH AND SLIGHTLY SALINE GROUND WATER IN THE BASINS OF WESTERNMOST TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-05877

MAPS SHOWING GROUND-WATER CONDITIONS IN THE NORTHERN PART OF THE GILA RIVER DRAINAGE FROM PAINTED ROCK DAM TO TEXAS HILL AREA, MARICOPA, PIMA, AND YUMA COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-05882

MAPS SHOWING GROUND-WATER CONDITIONS IN THE GILA RIVER DRAINAGE FROM TEXAS HILL TO DOME AREA AND IN THE WESTERN MEXICAN DRAINAGE AREA, MARICOPA, PIMA, AND YUMA COUNTIES, ARIZONA--1977.
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-05883

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--LOWER COLORADO REGION,
Geological Survey, Tucson, AZ. Water Resources Div.
E. S. Davidson.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.00. Geological Survey Professional Paper 813-R, 1979. 23 p, 6 Fig, 3 Plates, 3 Tab, 63 Ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Regional analysis, *Water management(Applied), *Water resources development, Water supply, Water utilization, Arid climates, Irrigation, Crops, Water levels, Pumping, Aquifers, Water wells, Groundwater recharge, Water storage, Water yield, Water quality, Water pollution, Sewage effluent, Saline water, Groundwater mining, Water law, Evaluation, Arizona, California, Nevada, New Mexico, Utah, *Lower Colorado region, *Colorado River basin.

Much of the water used in the semiarid lower Colorado River region is ground water, and pumpage is in excess of replenishment. In the southwest depth to water generally is about 200 to 500 feet below the land surface, irrigation and public-supply wells generally yield 500 to 1,500 gallons per minute, and about 1 billion acre-feet of ground water potentially is recoverable from storage. In the northeast water levels generally are more than 500 feet below the land surface, most wells yield between 10 and 500 gallons per minute, and 150

million acre-feet or possibly more could be recovered. Annual storage depletion, almost entirely in the southwest, is about 2.4 to 3.2 million acre-feet. Almost 6 million acre-feet is pumped annually, mostly for crops. Subsidence, earth cracks, increasing pumping costs, and water quality limit potential ground-water development. However, some gains can be made through changes and greater efficiencies of use and by reducing evapotranspiration. Prior use and economics determine water use in Arizona-the largest part of the region. All States except Arizona have laws that allow control and allocation of ground water by the State. (Kosco-USGS)
W80-05885

4C. Effects On Water Of Man's Non-Water Activities

URBAN STORM RUNOFF QUALITY IN SOUTHEAST MICHIGAN,
Environmental Research Group Inc., Ann Arbor. Dept. of Environmental Assessment.
P. G. Collins, and J. W. Ridgway.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE1, Proceedings Paper 15199, p 153-162, February 1980. 2 Fig, 3 Tab, 10 Ref, 1 Append.

Descriptors: *Storm runoff, *Urban runoff, *Water pollution sources, *Water quality, Runoff, Drainage, Surface runoff, Cities, Water pollution, Pollutants, Suspended solids, Model studies, On-site investigations, Sampling, Correlation analysis.

Methods of sampling urban runoff and its impacts on receiving waters were reviewed and classified into three types. The field designs which yield data on mass emissions were generally most useful for evaluating alternatives to control urban nonpoint pollution. Recent field sampling of urban runoff in the Detroit area (southeast Michigan) permitted better characterization of urban runoff quality, distribution of sizes of solids in runoff, and correlations of suspended solids with other constituents in runoff. It was concluded that region-specific runoff data are useful to planners and engineers engaged in analysis of alternative control strategies. Data from southeast Michigan indicated that certain aspects of the urban nonpoint problem are not amenable to some source controls, such as street sweeping, but suggest that hydrologic modifications, such as detention and increased infiltration, may be more effective. (Sims-ISWS)
W80-05728

SESTON DYNAMICS IN SOUTHERN APPALACHIAN STREAMS: EFFECTS OF CLEAR-CUTTING,
Georgia Univ., Athens. Dept. of Entomology.
M. E. Gurtz, J. R. Webster, and J. B. Wallace.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 4, p 624-631, April 1980. 7 Fig, 4 Tab, 28 Ref. NSF DEB77-05234-A01.

Descriptors: *Streams, *Forest watersheds, *Clear-cutting, *North Carolina, *Seston, Suspended solids, Effects, Watersheds(Basins), Land management, Appalachian Mountain Region, Sediments, Detritus, Rainfall, Streamflow, On-site investigations, Roads, Particle size, Organic matter, *Big Hurricane Branch(NC), *Hugh White Creek(NC).

Suspended particulate matter (seston) was studied from July 1977 to July 1978 in two second-order streams in the southern Appalachian Mountains. In the first stream, which drains an undisturbed hardwood forest watershed, seston concentrations fluctuated with season (lowest during winter high flows) and with storm flows. Most organic and inorganic particles were smaller than 105 micrometer diameter. The second stream drains a watershed (formerly a hardwood forest) that was clear-cut in early 1977. Increased levels of both organic and inorganic seston were found in the latter stream, especially beginning 1 yr after clear-cutting (2 yr after construction of logging roads). Particles larger than 234 micrometer in diameter accounted for most of the increases in inorganic seston. These increases were probably due to sediments deposited in the stream bed during road building and transported downstream during periods of peak flow. Increased levels of organic seston were probably related to breakdown of debris that entered the stream during logging and reduced retention by leaf packs. It was hypothesized that eventual recovery of the stream will be limited by the rate of recovery of the surrounding terrestrial ecosystem. (Humphreys-ISWS)
W80-05770

IS YOUR WEATHER BEING MODIFIED,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 106, No IR1, Proceedings Paper 15253, p 37-48, March 1980. 2 Fig, 3 Tab, 11 Ref, 1 Append. NSF ENV77-15375.

Descriptors: *Climatology, *Design, *Weather modification, Energy, Hydrology, Water resources, Weather, Water supply, Land use, Planning, City planning, *Atmospheric modification, *Regional planning, Land use changes, Urban development, Unintentional changes, Inadvertent weather modification, Regional weather changes.

Most of the atmospheric modification that exists in the United States is occurring accidentally as a result of man's land-use changes. Cities, power plants, and certain agricultural activities modify the weather, often dramatically, on local and regional scales. These unintentional changes are so important and widespread that study of their scale and nature is essential in many design and policy areas. Knowing more about inadvertent weather modification has become a part of wise planning for hydrologic, agricultural, transportation systems, and activities. Furthermore, regional weather changes due to man's use of land may reduce or enhance the effectiveness of efforts to purposefully modify the weather. (Roberts-ISWS)
W80-05778

CALIFORNIA MEETS THE LNG TERMINAL,
California Coastal Commission, San Francisco.
For primary bibliographic entry see Field 6E.
W80-05899

PUBLIC INVOLVEMENT IN OFFSHORE OIL DEVELOPMENT: LESSONS FROM NEW ENGLAND,
Rhose Island Univ., Kingston. Coastal Resources Center.
For primary bibliographic entry see Field 6E.
W80-05900

OCS DEVELOPMEN: A NEW LAW AND A NEW BEGINNING,
House, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-05901

IRONDEQUOIT BAY DEVELOPMENT PLANNING: SOME IMPLICATIONS FOR INSTITUTIONAL REFORM,
For primary bibliographic entry see Field 6E.
W80-05911

THE ACQUISITION OF DEVELOPMENT RIGHTS IN THE COASTAL ZONE: AN ALTERNATIVE TO WETLANDS REGULATION,
For primary bibliographic entry see Field 6E.
W80-05913

INTRODUCTION AND APPLICATION OF KINEMATIC WAVE ROUTING TECHNIQUES USING HEC-1,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2E.
W80-05929

ROAD SALT MOVEMENT INTO TWO TORONTO STREAMS,
Ontario Hydrology, Toronto. Dept. of Transmission Environment.
W. S. Scott.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE3, Proceedings Paper 15468, p 547-560, June 1980. 8 Fig, 4 Tab, 12 Ref, 1 Append.

Descriptors: *Roads, *Deicers, *Salts, *Canada, Runoff, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Chlorides, Snow, Ice, Cities, Urban runoff, Water quality, Watersheds(Basins), Sampling, Environmental effects, *Toronto(Ontario).

The temporal and spatial pattern of movement of deicing salts from road surfaces to stream channels was investigated in two Metropolitan Toronto stream systems. In the early stages of thaw periods, large increases in the early stages of thaw periods, large increases in stream chloride occurred immediately downstream from road crossing points. As the thaws continued and more heat accumulated, chloride concentrations decreased; and during the latter stages of the thaws, concentration was more uniform throuthout the stream as the effect of dilution increased. These general patterns occurred in both urban and rural areas, but the urban areas were characterized by a more rapid and complete removal of salt, while in rural areas, the accumulation of snow and ice in roadside ditches may take some time to melt during thaw periods creating a time lag in the movement of deicing salts to watercourses. (Sims-ISWS)
W80-05942

WATER POLLUTION FROM SNOW REMOVAL OPERATIONS,
SEA Inc., Rochester, NH.
B. W. Pierstorff, and P. L. Bishop.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE2, Proceedings Paper 15331, p 377-388, April 1980. 1 Fig, 3 Tab, 15 Ref, 1 Append.

Descriptors: *Water pollution, *Pollutants, *Snow, *Road, *New Hampshire, Water quality, Hydrogen ion concentration, Chlorides, Suspended solids, Biochemical oxygen demand, Chemical oxygen demand, Coliforms, Lead, Sediments, Rivers, Estuaries, Sampling, On-site investigations, Data processing, Snow removal.

Analyses performed on snow samples obtained from snow removal dump sites indicated the presence of substantial quantities of contaminants. This snow, removed from roads, highways, and parking areas, contained high levels of total solids, suspended solids, chlorides, COD, and lead. Over a 2-yr period the mean concentrations for these five pollutants were 5080 mg/1, 1570 mg/1, 2470 mg/1, 281 mg/1, and 3.4 mg/1, respectively. Of particular concern was the high lead concentration, presumably originating from automobile exhaust. Essentially all of the lead was found to be associated with the particulate matter. Lead analyses performed on sediment samples from the river into which the dumped snow was pushed indicated that the lead from the snow may become trapped in the river sediment near the site due to inhibition of the transport of the suspended lead rich material. (Sims-ISWS)
W80-05945

STORMWATER DRAINAGE IN URBAN AREAS,
National Building Research Inst., Pretoria (South Africa).
For primary bibliographic entry see Field 2E.
W80-05994

4D. Watershed Protection

SOUTHERN ILLINOIS MINE WASTE CONTROL PLAN: A SUMMARY,
Environmental Design and Planning, Inc., Cambridge, MS.
W. C. Pisano, and G. L. Aronson.
Journal of the Environmental Engineering Divi-

sion, American Society of Civil Engineers, Vol 106, No EE1, Proceedings Paper 15167, p 55-68, February 1980. 3 Fig, 3 Tab.

Descriptors: *Water pollution control, *Mine drainage, *Coal mine wastes, *Model studies, *Illinois, Mathematical models, Water pollution, Water pollution sources, Mining, Coal mines, Strip mines, Strip mine wastes, Mine acids, Acid mine water, Mine wastes, Water quality, Water quality control, Environmental engineering, *Southern Illinois, *Big Muddy River Basin, *Saline River Basin.

This paper summarized the results of a 2-yr study aimed at assessing the 300-sq mile acid mine drainage impacted area within southern Illinois, funded by Section 208 of PL 92-500. The 208 Plan focused on upgrading existing water quality through reclamation of mine-related pollution sources, especially those pertaining to past mining activities, utilizing monies generated under the Surface Mining Control and Reclamation Act of 1977 (PL-95-87), providing for a national reclamation fund based on a surtax on all present and future coal production. Study program elements included: inventorying all mine waste sources within the Big Muddy and Saline River Basins, conducting a long-term sampling and flow gaging program to provide water quality data throughout the two water-sheds, and development of a computer-based simulation model of the two river systems to allow for assessment of water quality for both present and future projected conditions as well as assessment of reclamation and mine waste control feasibility throughout the area. (Sims-ISWS)
W80-05723

ESTIMATING YOUR SOIL-EROSION LOSSES WITH THE UNIVERSAL SOIL LOSS EQUATION,
Illinois Univ. at Urbana-Champaign. Cooperative Extension Service.
R. D. Walker, and R. A. Pope.
Document No 80/03, February 1980. 20 p, 2 Fig, 5 Tab, 2 Append. 20.078.

Descriptors: *Soil erosion, *Soil types, *Illinois, *Land use, Erosion control, Cultivation, Soil conservation, Data collections, Crops, Rainfall, Analytical techniques, Methodology, Sheet erosion, Rill erosion, Universal soil loss equation, Soil erodibility.

The Universal Soil Loss Equation (USLE), developed by the U.S. Department of Agriculture, the state experiment stations, and the Soil Conservation Service (SCS), provides a convenient way to estimate the rate of soil loss due to sheet-and-rill erosion on land so that one can see how that rate compares with new limits. It can also be used to get an idea of what effect various changes in farming practices would have on the rate of soil loss. The equation does not estimate soil erosion from gullies or stream banks or the amount of sediment reaching streams. The estimate will be the average annual sheet-and-rill soil erosion that will occur on the specific field segment where the estimate is made. The USLE was developed using research data from many stations, including work at Dixon Springs, Urbana, and Elwood, Illinois. More than 10,000 plot years of data were analyzed to reduce the factors in the equation to numbers that could be easily used. The USLE reflects the influences of the major factors known to affect rainfall erosion: R x LS x K x C x P = A; where R = rainfall, LS = length and steepness of slope, K = soil erodibility, C = crop cover and management, P = conservation practices, and A = the soil-erosion loss. (Humphreys-ISWS)
W80-05764

A MODEL STUDY OF A SYNTHETIC FABRIC MATERIAL FOR USE AS A SLOPE PROTECTION METHOD ON IRRIGATION DAMS,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
L. D. McCallister.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-201924, Price codes: A10 in paper copy, A01 in microfiche. Ms Thesis, 1979. 205p, 92 Fig, 9 Tab, 50 Ref, 4 Append. OWRT B-124-MO(1).

Descriptors: *Erosion control, *Bank protection, *Slope protection, Bank stability, Check structures, Embankments, Riprap, Slope stability, Waves(Water), Irrigation water, Central U.S., Missouri, Earth dams, *Model studies, *Synthetic fabric, Evaluation, Costs.

A three phase program involving laboratory and field investigation was used to test a new synthetic fabric, Acrilan, designed to be used in the form of soil-filled 'sand pillows' for reservoir bank or slope protection from wave erosion. Irrigation reservoirs in the Midwest often have severe erosion problems due to the lack of quality control during construction, the flat topography with little wind shelter, and the fine-grained quality of the soil. Acrilan has several advantages over other slope protection materials: (1) outstanding biodegradation and ultraviolet light resistance, (2) ease and economy of installation, (3) ease of repair, and (4) excellent cost/benefit relationships. The sand pillow system with Acrilan was modeled to evaluate the parameters that affect the stability of the pillows when placed on an embankment slope. Modeling results were used to develop design cirteria for the individual pillows. Soil retention ability of the fabric was tested by laboratory immersion tests where the fabric was subjected to constant wave action. The field tests were conducted on a pump-in irrigation dam in north central Missouri. Erosion rates of unprotected sections were compared with rates on protected sections of the same embankment. Results show that sand pillow stability is primarily a function of wave height, wave period, embankment slope angle, and pillow weight. The sand pillow method offers excellent slope protection, however, due to loss through the fabric, some limiting minimum particle size specification is needed. (Seigler-IPA)
W80-05806

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

GROUND-WATER-QUALITY DATA FROM THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2K.
W80-05717

SEMICONTINUOUS MONITORING OF TRULY DISSOLVED FORMS OF TRACE ELEMENTS IN STREAMS USING DIALYSIS IN SITU--I. PRINCIPLE AND CONDITIONS,
Technical Univ. of Prague (Czechoslovakia). Dept. of Nuclear Chemistry.
P. Benes.
Water Research, Vol 14, No 5, p 511-513, 1980. 13 Ref.

Descriptors: *Trace elements, *Sampling, *Streams, *On-site investigations, Methodology, Theoretical analysis, Pollutants, Pollutant identification, Dialysis, Chemicals, Equipment, Monitoring, Water quality, Water pollution, Trace element monitoring.

A new method of semicontinuous monitoring was described which consists of immersing a dialysis cell filled with pure water into the stream to be monitored. Dissolved species diffuse through a dialysis membrane into the cell, where they are removed from the solution, for instance by adsorption. If the concentration of a dissolved species in the solution inside the cell is maintained at a very low value as compared with the concentration outside the cell, the diffusion flow is directly proportional to the concentration of the dissolved species in the stream water, and the mean stream concentration for the monitoring period can be determined from the total amount of the monitored species accumulated in the cell. Basic conditions and limitations of the method were discussed. (Sims-ISWS)
W80-05724

POLLUTANT CONCENTRATIONS FROM HOMOGENOUS LAND USES,
Metropolitan Sanitary District of Greater Chicago, IL.
For primary bibliographic entry see Field 5B.
W80-05725

URBAN STORM RUNOFF QUALITY IN SOUTHEAST MICHIGAN,
Environmental Research Group Inc., Ann Arbor. Dept. of Environmental Assessment.
For primary bibliographic entry see Field 4C.
W80-05728

WELL-WATER QUALITY CHANGES CORRELATED WITH WELL PUMPING TIME AND AQUIFER PARAMETERS--FRESNO, CALIFORNIA,
Science and Education Administration, Fresno, CA. Water Management Research.
H. I. Nightingale, and W. C. Bianchi.
Ground Water, Vol 18, No 3, p 274-280, May-June 1980. 8 Fig, 2 Tab, 15 Ref.

Descriptors: *Groundwater, *Water quality, *Variability, *Pumping, *California, Aquifers, Wells, Water wells, Nitrogen, Nitrogen compounds, Nitrates, Transmissivity, Specific capacity, Data processing, Statistics, Artificial recharge, On-site investigations, Pollutant identification, *Fresno(CA).

Groundwater chemical quality in alluvial valleys can be stratified, which can cause well-water quality to vary with pumping time, especially after a pump shutdown of several hours. These changes in chemical quality could have public health implications for automatically controlled, high capacity municipal water wells that pump directly into the distribution mains. For a large number of municipal wells, the shapes of the curves for the change-in-specific electrical conductivity and the N03-N content of well water during the first 96 minutes of constant rate pumping were reported after a 24-hour shutdown as compared with 'steady-state' quality. The variables recovery-transmissivity, well specific capacity, type of well construction, and equivalent specific yield of aquifer computed from driller's logs of the boreholes were considered in the analysis. The results showed that well-water quality vs. time curves vary in shape and are related mainly to the well depth and the depth to the perforations. The 'steady-state' specific electrical conductivity and N03-N values were significantly correlated to each other and inversely to recovery-transmissivity and equivalent specific yield. The specific capacity of wells was related to the recovery-transmissivity and to type of well construction. (Sims-ISWS)
W80-05745

METHODOLOGY FOR MONITORING GROUND WATER AT URANIUM SOLUTION MINES,
Texas Univ. at Austin. Dept. of Civil Engineering.
M. J. Humenick, L. J. Turk, and M. P. Colchin.
Ground Water, Vol 18, No 3, p 262-273, May-June 1980. 8 Fig, 6 Tab, 21 Ref.

Descriptors: *Groundwater, *Monitoring, *Methodology, Water chemistry, Observation wells, Sampling, Hydrogeology, Wells, Pumping, Chemicals, Water temperature, Hydrogen ion concentration, Spatial distribution, Variability, Mining, Leaching, Uranium, Solution mines.

Monitoring the chemistry of groundwater near in-situ uranium leach mines is complicated by chemical variations unrelated to the mining operation that result from: (1) spatial differences in the aquifer environment and hence in the water chemistry, (2) inconsistent or inadequate sampling procedures, and (3) errors in chemical analyses. Differences in the chemistry of water from place to place in the aquifer should be identified in pre-mining baseline studies and must be taken into account during monitoring of the leaching oper-

ation because natural waters of chemistry different from that established at a particular well during the baseline sampling period may be drawn into the monitoring well by pumping. The most important factor in developing proper sampling techniques is the configuration of the well and pumping equipment; if the pump intake is set near the point where water enters the well, and if the pumping rate is kept low to reduce turbulent mixing of waters in the well, it is not necessary to pump a full wellbore volume before collecting a sample. Errors in chemical data can be eliminated by proper storage and handling of the samples and by careful checking of the analyses for chemical balance and eliminating the analyses that do not balance properly. Interpretation of the chemical data should be made only after assuring that these monitoring problems have been taken into account. (Sims-ISWS)
W80-05746

ROLE OF RILL DEVELOPMENT IN SALT LOADING FROM HILLSLOPES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2K.
W80-05752

TRACKING THE MICROPOLLUTANT,
Water Research Centre, London (England).
R. Forster.
Water, No 32, p 7-9, May 1980. 6 Fig.

Descriptors: *Water analysis, *Pollutant identification, *Aquatic microbiology, Microorganisms, Public health, Laboratory tests, Analytical techniques, Water quality, Diseases, Human pathology, Pesticide residues, Potable water, Toxicity, Carcinogens, Mutagens.

Short-term tests for the detection of mutagens in drinking water are becoming increasingly valuable as tools for assessing potential health hazards associated with water. These tests depend upon a close correlation between carcinogenicity and mutagenicity. These short-term tests use bacteria and other lower organisms to detect mutagenicity because they are very sensitive, can be cultivated cheaply, and are testable in large numbers. Dr. Bruce Ames of the University of California has developed a very important set of Salmonella typhimurium tester strains. These strains have a number of genetic features which enhance their sensitivity to chemical mutagenesis. The Salmonella/Mammalian microsome test or Ames test has been used to identify environmental chemicals which have carcinogenic potential such as Tris-BP flame retardant, the food additive furylfuramide, and hair-dry constituent chemicals. While these short-term tests have many advantages over the traditional long-term animal test for carcinogenity, there are difficulties since the correlation between mutagenicity and carcinogenicity is not perfect. The application of short-term tests to drinking water samples involves a concentration step followed by a mutagenicity test system. The Water Research Centre has developed a very sensitive system called the Fluctuation Test, based on a 'classical' study. While it is not appropriate at this time to use short-term tests as determinants of water quality, there is much potential for the near future. (Seigler-IPA)
W80-05756

OBSERVATIONS ON THE ESTIMATION OF TOTAL ORGANIC CARBON FROM U.V. ABSORBANCE FOR AN UNPOLLUTED STREAM,
Aberdeen Univ. (Scotland). Dept. of Soil Sciences.
For primary bibliographic entry see Field 2K.
W80-05779

HETEROTROPHIC BACTERIA IN TWO CANADIAN RIVERS--I. SEASONAL VARIATIONS IN THE PREDOMINANT BACTERIAL POPULATIONS,
New Brunswick Univ., Fredericton. Microbiology Research Lab.
For primary bibliographic entry see Field 5C.
W80-05781

FORMATION AND CONTROL OF TRITHALOMETHANES IN CHLORINATED DRINKING WATERS CONTAINING FULVIC ACID,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
D. J. O'Brien, R. L. Bixby, M. A. Jewett, and K. M. Stewart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-200140, Price codes: A05 in paper copy, A01 in microfiche. Water Resource Research Center, Univ. of NH. Research Report 27, 1980. 82 p, 23 Fig, 14 Tab, 36 Ref, 4 Append. OWRT A-048-NH(3), 14-34-0001-8031.

Descriptors: *Water treatment, *Chlorination, *Coagulation, *Fulvic acids, *Chromatography, Environmental engineering, Chlorine, Chemical reactions, Organic matter, *Trihalomethane, *Chloroform, *Drinking water, *Humic substances, *Water treatment processes, Alum, Sephadex, Fractionation, Infrared spectroscopy, Nuclear magnetic resonance(NMR) spectroscopy.

The formation of halogenated organic compounds in drinking waters is a potentially serious environmental problem. This study examined the production of trihalomethanes by the chlorination of drinking waters containing fulvic acid and the effects of conventional water treatment processes on this phenomenon. Initially, fulvic acid was further fractionated into four subfractions by column chromatographic techniques. Chemical analysis via C-H-N-O elemental analysis, infrared spectroscopy, and nuclear magnetic resonance spectroscopy was employed to gain information on functional group content and distribution. The chlorination of fulvic acid fractions confirmed that fulvic acid compounds are significant precursors to trihalomethane formation and indicated that a number of chemical structures and functional groups is involved in the haloform reaction. The removal of fulvic acid in coagulation processes and its relationship to trihalomethane formation upon subsequent chlorination were studied in controlled experiments. Results indicated that coagulation does not uniformly remove all fulvic acid compounds. Evidence suggests that low molecular weight aromatic compounds are poorly removed by coagulation processes. In addition, studies demonstrated that the chloroform yield of fulvic acid compounds decreased significantly following coagulation.
W80-05802

THE SEDIMENTS OF PRESQUE ISLE HARBOR, LAKE SUPERIOR,
Northern Michigan Univ., Marquette. Dept. of Chemistry.
D. L. Macalady.
Available from the National Technical Information Service, Springfield, VA 22161 as PB0-203870, Price codes: A11 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, East Lansing, Project Completion Report May, 1980. 227 p, 114 Fig, 41 Tab, 86 Ref. OWRT B-050-MICH(1), 14-34-0001-8091.

Descriptors: *Sediments, *Sediment-water interfaces, *Heavy metals, *Trace elements, Interstitial water, Harbors, Dredging, Dredge-spoil disposal, Diffusion, Trace metals, Analytical techniques, Bottom sampling, *Lead isotope ratios, Lead copper, Zinc, Water chemistry, *Lake Superior, Great Lakes, *Presque Isle Harbor(MI), Marquette(MI), Michigan.

Measurements by anodic stripping and atomic adsorption of cadmium, copper, lead and zinc in sediment core segments and overlying interfacial and interstitial water in Presque Isle Harbor, Marquette, Michigan are reported. These data, plus water chemical parameters, particle size distribution, cation exchange capacity and total volatile solids are used to evaluate the nature of trace metals in the variable sandy sediments of the harbor. Results show metals mobilized generally away from the sediment-water interface in more highly disturbed areas with little mobilization in the less distubed areas. The metals data plus a comparison series of analyses of surficial sediments for COD, TKN, oil and grease and total P04(-3) indicate that the present classification of harbor sediments which has required on-land disposal of dredging spoils is not consistent with present contaminant levels. It is recommended that the harbor be changed to 'non-polluted' status. Revised dredge spoil disposal criteria, in general, are recommended to include (1) visual SCUBA diver surveys of dredging areas to locate problem sediments; (2) analyses of sediment cores rather than surficial sediments; and (3) inclusion of acid-leachable metals analysis. These recommendations are discussed relative to those of other studies. The report includes development of sampling and analysis protocols for interstitial waters of shallow sandy sediments. Evidence is presented that freezing sediment cores is not an acceptable procedure.
W80-05832

IN SITU DETERMINATION OF SUSPENDED PARTICULATE MATTER AND DISSOLVED ORGANIC MATTER CONCENTRATIONS IN AN ESTUARINE ENVIRONMENT BY MEANS OF AN OPTICAL BEAM ATTENUANCE METER,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Geoscience Centre.
For primary bibliographic entry see Field 2L.
W80-05849

A COMPARISON OF METHODS AND INSTRUMENTATION OF BIOLOGICAL EARLY WARNING SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-05858

ANALYSES OF NATIVE WATER, BOTTOM MATERIAL, AND ELUTRIATE SAMPLES OF SOUTHERN LOUISIANA WATERWAYS, 1977-78,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. J. Bupuy, and N. P. Couvillion.
Geological Survey open-file report 79-1484, September 1979. 414 p, 21 plates, 21 Tab, 12 Ref.

Descriptors: *Navigable waters, *Environmental effects, *Dredging, *Louisiana, Sampling, Water analysis, Bottom sediments, Water quality, Chemical analysis, Metals, Pesticides, Nutrients, Organic compounds, Evaluation, Path of pollutants, *Elutriate, *Southern Louisiana waterways.

From March 1977 to July 1978 the U.S. Geological Survey in cooperation with the U.S. Army Corps of Engineers conducted a series of elutriate studies to determine water quality in selected reaches of major navigable waterways of southern Louisiana. Sample were collected from the Mississippi River-Gulf Outlet areas; Mississippi River, South Pass; Baptiste Collette Bayou; Tiger Pass area; Baou Long; Bayou Barataria and Barataria Bay Waterway area (gulf section); Bayou Segnette Waterway, Lake Pontchartrain near Tangipahoa River mouth; Bayou Grand Caillou; Bayou la Carpe at Homa; Houma Navigation Canal and Terrebonne Bay; Bayou Boeuf, Bayou Chene, and Baou Black, Atchafalaya River Channel, Atchafalaya Bay; Old River Lock tailbay; Red River below mouth of Black River; Freshwaer Canal; Mermentau River and Lake Arthur Mermentau River outlet; and Calcasieu Ship Channel. The studies were initiated at the request of the U.S. Army Corps of Engineers to evaluate possible environmental effects of proposed dredging activities in those waterways. The U.S. Army Corps of Engineers and U.S. Geological Survey collected 189 samples of native water and 172 samples of bottom (bed) material from 163 different sites. A total of 117 elutriates (Mixtures of native water and bottom material) were prepared. The native water and elutriate samples were analyzed for selected metals, pesticides, nutrients organics, and pysical constituents. Particle-size determinations were made on bottom-material samples. (Kosco-USGS)
W80-05867

RESEARCH FOR A DRY LAND.
Scientiae (Pretoria), Vol 19, No 3, p 19-21, 1978. 1

Group 5A—Identification Of Pollutants

Fig.

Descriptors: *Water supply, *Semiarid climates, *Grasslands, *Groundwater, *Water qulity, Mapping, Desalination, Reverse osmosis, Solar stills, Denitrification, Water purification, Water analysis, Chemical analysis, Water demand, Dependable supply, Water resources, Waste treatment, Water reuse, South West Africa.

The CSIR opened the National Institute for Water Research (NIWR) in 1956 in Winhoek, South West Africa, to gain scientific and technical knowledge and skills in water management. The low rainfall in the area prompted research in three areas: (1) groundwater quality; (2) desalination; and (3) biological monitoring of Winhoek's municipal water supply (which is occasionally supplimented by up to 10% of water reclaimed from purified sewage effluent). About 20,900 water sources in the territory have been mapped and stored on tape for water management and water quality control planning. Desalination of South West Africa's abundant highly mineralized underground water constitutes a major water source. Solar distillation is practical on a small scale but reverse osmos is for desalting of brackish groundwater is more advantageous for industry. An ion-exchange method to denitrify groundwater has recently been develed by the NIWR. Biological anaerobic denitrification using molasses as a carbon source is being investigated for use by farmers. Testing of the microbiological quality of all water in game reserves in the territory and investigations into anthrax spore occurrnce in water and its effect on game species have recently been undertaken. (Sidney-IPA)
W80-05923

QUANTITATION OF POLLUTANTS IN SUSPENDED MATTER AND WATER FROM PUGET SOUND,
Battelle Pacific Northwest Lab., Richland, WA.
G. Riley, E. A. Crecelius, D. C. Mann, K. H. Abel, and B. L. Thomas.
National Oceanic and Atmospheric Administration. Technical Memorandum ERL MESA-49, April 1980. 105 p, 19 Fig, 16 Tab, 44 Ref.

Descriptors: *Pollutant identification, *Water pollution, *Suspended loads, *Metals, *Aromatic compounds, Environmental effects, Ecosystems, Washington, Arsenic, Copper, Lead, Antimony, Zinc, *Puget Sound(WA), Hydrocarbons, Petroleum, Environmental impact.

Puget Sound waters contained suspended matter uncontaminated by metals except for Elliott and Commencement Bays. Five metals (arsenic (As), copper (Cu), lead (Pb), antimony (Sb) and zinc (Zn)) were elevated in suspended locations at stations in Elliott and Commencement Bay compared to control locations in Puget Sound and the Pacific Northwest. In addition, five or more of a list of nine aromatic hydrocarbons (naphthalene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz(a)anthracene, chrysens, benzo(a)pyrene) were identified in suspended matter from each sampling site. The staturate hydrocarbon content of suspended matter appeared to reflect biogenic distributions and concentrations with the exception of Hylebos and Blair Waterways where saturate hydrocaron distributions indicated input of petroleum or its refined products. These results are further discussed with respect to environmental impact and the planning of future research studies in Puget Sound by the NOAA/MESA Puget Sound Project. (NOAA)
W80-05924

AGRICULTURAL RUNOFF DURING A DROUGHT PERIOD,
Science and Education Administration, Lincoln, NE.
For primary bibliographic entry see Field 5B.
W80-05933

AQUEOUS-AND SEDIMENT-PHASE NITROGEN YIELDS FROM FIVE SOUTHERN PINE WATERSHEDS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W80-05939

LOW FLOW AND STORMWATER QUALITY IN URBAN CHANNELS,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
P. B. Bedient, J. L. Lambert, and P. Machado.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE2 Proceedings Paper 15336, p 421-436, April 1980. 5 Fig, 9 Tab, 21 Ref.

Descriptors: *Low flow, *Water quality, *Urban runoff, *Texas, *Monitoring, *Model studies, Mathematical models, Pollutants, Suspended solids, Algae, Dissolved oxygen, Diurnal, Nutrients, Bliochemical oxygen demand, Surveys, Sampling, Storm water, Stom runoff, Cities, *Houston(TX).

A water quality monitoring effort in a concrete-lined, urban channel yielded a comprehensive data base to evaluate low flow and stormwater quality. The low flow effluent-dominated regime was affected largely by benthic algal production and respiration resulting in large diurnal DO fluctuations. QUAL II was used to simulate the system as an aid in defining cause-effect relationships and to calculate production and respiration rates which were much higher than those reported for natural stream systems. Stormwater effects on DO were found to be minimal with BOD sub 5 levels low and DO levels near saturation. Stormwater loads of totl suspended solids and nutrients were found to be a major contributor to total pollutant loads. (Sims-ISWS)
W80-05943

GROUND-WATER POLLUTION BY SEPTIC TANK DRAINFIELDS,
Washington Univ., Seattle. Dept. of Environmental Health.
F. B. DeWalle, and R. M. Schaff.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE3, Proceedings Paper 15496, p 631-646l, June 11980. 7 Fig, 5 Tab, 11 Ref, 1 Append.

Descriptors: *Water pollution, *Groundwater, *Septic tanks, *Washington, Nitrates, Chemicals, Calcium, Magnesium, Hardness(Water), Phosphorus, Chlorides, Sodium, Potassium, Water quality, Ion exchange, Wells, Water Wells, Groundwater quality.

Analytical results from 386 groundwater samples were used to determine the effect of septic drainfield leaching on groundwater quality. The calcium carbonate type groundwater showed lower correlation coefficient between its main parameters in unsewered areas than in sewered areas. The negative correlation between calcium and sodium, the significant increase of calcium with time and with decreasing well depth points to a cation exchange in which sodium from sewage effluent is exchanged by calcium. The increase of calcium, chloride, and nitrate with time was most significant in unsewered areas served by septic tanks. Highest nitrate and coliform concentrations were noted in the winter during maximum infiltration. (Sims-ISWS)
W80-05958

A SEMI-AUTOMATED RESIN CONCENTRATION METHOD FOR THE PRECONCENTRATION OF TRACE METALS IN FRESH WATER, PRIOR TO ATOMIC ABSORTPTION ANALYSIS,
Hydrological Research Inst., Pretoria (South Africa).
P. L. Kempster, and H. R. Van Vliet.
Water SA (Pretoria), Vol 4, No 3, p 125-128, 1978. 1 Fig, 3 Tab, 9 Ref.

Descriptors: *Water analysis, *Trace elements, *Cation exchange, *Instrumentation, Flow control, Flow rate, Pumping, Chromium, Manganese, Iron, Cobalt, Nickel, Copper, Zinc, Cadmium.

A semi-automated method of sample preconcentration for trace metal analysis by atomic absorption is described. Water samples were passed throuth a column of a cation exchange resin (Amberlite IR-120/H) to concentrate chromium, manganese, iron, cobalt, nickel, copper, zinc, cadmium, and lead. The flow rate was controlled by a peristaltic pump to ensure reproducibility of the results. The water samples were stabilized with ascorbic acid (0.5 gram per liter) at pH 2.5 before absorption onto the resin. The accuracy of the method was tested by spiking samples with known concentrations of various metal cations, preconcentrating, and analyzing the samples. The seven metals determined gave mean recoveries between 91% and 97%, although there was some difficulty obtaining consistent results for iron. Iron recovery varied from 91% in sample no. 1 to 75% in sample no. 2; the reason for this discrepancy is not known. This method is especially useful for preconcentration of large numbers of samples. (Sidney-IPA)
W80-05980

WATER ANALYSIS IN SOUTH AFRICA: INTER-LABORATORY COMPARISON STUDIES. PART III: NUTRIENT ANALYSIS,
National Inst. for Water Research, Pretoria (South Africa).
R. Smith.
Water Sa (Pretoria), Vol 4, No 4, p 161-168, 11978. 6 Fig, 5 Tab, 14 Ref.

Descriptors: *Water analysis, *Analytical techniqus, *Laboratories, *Nutrients, *Performance, Nitrates, Nitrites, Nitrogen compounds, Phosphates, Methodology, Reliability, Standards, Correlation analysis, Statistics, *South Africa.

A program of interlaboratory comparison studies involving South African laboratories perfoming water analyses was continued in part III: nutrient analysis. Each of the seventeen participating laboratories were given standardized samples for Kjeldahl ammoia, nitrate, and nitrite nitrogen, and total and ortho-phosphate, The labatories were allowed to choose the analytical method. The data was analyzed for mean, mean error, relative mean error, standard deviation, and coefficient of variation and presented in graphical form for easy interpretation. Only 8% of the results received were unacceptable. Eight different digestion methods and three methods for the determination of the distilled ammonia were used in the Kjeldahl analyses. The cadmium reduction method for nitrate-nitrogen determinations was shown to be the preferred method. The standard sulfanilic acid procedure was generally used and all participants gave accurate and precise nitrate and nitrite analyses. A wide variety of digestion procedures was used for phosphate analysis and eight of the laboratories used the standard ascorbic acid reduction method of ortho-phosphate determination. The use of only recognized and standard methods of analysis was recommended. (Sidney-IPA)
W80-05989

5B. Sources Of Pollution

INTERIM DATA REPORT ON THE GEOHYDROLOGY OF THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEAST NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. W. Mercer, and B. R. Orr.
Geological Survey Water-Resources Investigations 79-98, July 1979. 178 p, 32 Fig, 46 Tab, 44 Ref.

Descriptors: Radioactive waste disposal, *Underground waste disposal, *Hydrogeology, *Hydrologic data, *New Mexico, Aquifer characteristics, Subsurface investigations, Groundwater movement, Permeability, Transmissivity, Water quality control, Nuclear wastes, Test wells, Sites, Planning, Evaluation, *Waste Isolation Pilot Plant(NM), *Southeast New Mexico.

Data collected at the proposed Waste Isolation Pilot Plant site in southeast New Mexico through September 1977 help define hydrologic conditions

at the contact between the Permian Rustler and Salado Formations, and Culebra and Magenta Dolomite Members of the Rustler Formation. Preliminary calculations of transmissivity along the Rustler-Salado contact range from 0.1 feet squared per day to 0.0001 feet squared per day. Fluids from the Rustler-Salado contact contain from 311,000 to 325,800 mg/l total dissolved solids. Fluids in the Culebra Dolomite Member move to the southeast at gradients ranging from 7 to 120 feet per mile. Preliminary transmissivity calculations range from 140 feet squared per day to 0.0004 feet squared per day. Total dissolved solids range from 23,721 to 29,683 mg/l. The extremely low vertical hydraulic conductivity within the Rustler Formation prevents fluid from communicating between the Magenta and Culebra Dolomite Members and between the Culebra and the Rustler-Salado contact. Heads are highest in the Magenta and lowest at the Rustler-Salado contact. (Kosco-USGS)
W80-05701

POLLUTANT CONCENTRATIONS FROM HOMOGENOUS LAND USES,
Metropolitan Sanitary District of Greater Chicago, IL.
I. Polls, and R. Lanyon.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE1, Proceedings Paper 15169, p 69-80, February 1980. 1 Fig, 4 Tab, 4 Ref, 1 Append.

Descriptors: *Pollutant identification, *Storm runoff, *Land use, *Illinois, Sampling, Automation, Runoff, Pollutants, Water pollution sources, Water quality, Storms, Storm water, Homogeneity, Cities, Urban runoff, Agriculture, Agricultural watersheds, Agricultural runoff, Forests, *Chicago(IL).

A stormwater-runoff sampling program was developed for a 208 areawide water quality study in northeastern Illinois. Analysis of the data collected with automatic sampling equipment from the 16 homogenous land-use watersheds during April through July, 1976, permitted generalized comparisons of runoff characteristics from the seven land-use categories. The quality data indicated that the mean concentration of most constitutents measured in stormwater did not vary significantly, except for total, suspended, and volatile solids. Commercial land use had the greatest concentration of pollutants in stormwater and the forest the least. When compared to sewage, the mean concentration for BOD(5), COD, and solids from nonpoint runoff were equal to or higher than concentrations found in wastewater receiving secondary treatment. By contrast, the mean concentrations for ammonium nitrogen, nitrite-nitrate nitrogen, and soluble phosphorus from stormwater were lower than in a secondary-treated effluent. (Sims-ISWS)
W80-05725

DYNAMIC WATER QUALITY MODELING IN SOUTHEAST FLORIDA,
GKY and Associates, Inc., Alexandria, VA.
R. U. Jettmar, G. K. Young, A. I. Perez, and R. Oros.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE1, Proceedings Paper 15173, p 105-124, February 1980. 12 Fig, 4 Tab, 12 Ref, 1 Append. EPA P-004146-01-0.

Descriptors: *Water quality, *Canals, *Land use, *Florida, *Model studies, Mathematical models, Computer models, Drainage, Hydraulics, Hydrology, Runoff, Storm runoff, Pollutants, Nitrogen, Ammonia, Carbon, Phosphorus, Lead, Dissolved oxygen, Algae, Bacteria, *Broward County(FL).

Two existing water quality mathematical models, STORM for stormwater runoff and RECEIV for receiving waters, have been adapted and applied to Broward County in southeast Florida. The modeling used land-use data, results of previous local stormwater quality studies and other local studies conducted by the U.S. Geological Survey, and results of a water quality sampling program. The RECEIV unsteady state model for the canal system was adapted to handle outflow through an underflow gate and reversals in flow direction. Calibration of the models is considered satisfactory, but additional information on pumpage and scouring/deposition of sediments would be helpful. First-order chemical reactions are not very important in wet weather conditions due to short residence times. Pollutant runoff rates by land use obtained by modeling were used to identify priority areas for future land-use planning. (Sims-ISWS)
W80-05726

URBAN STORM RUNOFF QUALITY IN SOUTHEAST MICHIGAN,
Environmental Research Group Inc., Ann Arbor. Dept. of Environmental Assessment.
For primary bibliographic entry see Field 4C.
W80-05728

SEDIMENT OXYGEN DEMAND AND NUTRIENT RELEASE,
Duncan, Lagnese and Associates, Inc., Pittsburgh, PA.
For primary bibliographic entry see Field 2J.
W80-05729

METHODOLOGY FOR EFFLUENT WATER QUALITY PREDICTION,
University of Southern California, Los Angeles. Environmental Engineering Program.
B. A. Eichenberger, and K. Y. Chen.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE1, Proceedings Paper 15212, p 197-209, February 1980. 5 Fig, 5 Tab, 15 Ref, 2 Append.

Descriptors: *Dredging, *Spoil banks, *Water pollution, *Model studies, Mathematical models, Suspended solids, Trace elements, Metals, Water quality, Sediments, Pollutants, Path of pollutants, Effluents, Sedimentation, Methodology, Theoretical analysis, Confined environments, Dredge spoil, Spoil.

A methodology for the prediction of effluent water quality from the disposal of dredged material in confined areas was presented. The computation method was based on the use of laboratory determination of contaminants in different particle size fractions together with the application of Hazen's theory of sedimentation for longitudinal basins. Hazen's equation was applied to each particle size fraction. The removal efficiency of each parameter can be obtained from the data of suspended solids removal and its concentration in that size fraction. The validity of this methodology has been verified in three active disposal sites. (Sims-ISWS)
W80-05730

DISTRIBUTION AND PROBABLE SOURCE OF NITRATE IN GROUND WATER OF PARADISE VALLEY, ARIZONA,
Oklahoma Univ., Norman. School of Geology and Geophysics.
B. A. Silver, and J. R. Fielden.
Ground Water, Vol 18, No 3, p 244-251, May-June 1980. 7 Fig, 21 Ref.

Descriptors: *Groundwater, *Nitrates, *Arizona, Spatial distribution, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Water quality, Sampling, Geology, Hydrogeology, Aquifers, Nitrogen, Nitrogen compounds, *Paradise Valley(AZ).

Field investigations in Paradise Valley, Arizona, conducted during 1974 and 1977, delineated areas of groundwater with up to 132 mg/l nitrate. Two alternative interpretations were developed as to possible sources of the excess nitrate. The first was a conventional interpretation identifying the use of nitrogenous fertilizers as the primary source and disposal of treated wastewater effluent as a secondary source. An alternative interpretation identified the source as a sand and gravel unit that is interpreted as a braided-stream deposit, located about 152 m (500 ft) below the land surface. The source of the nitrate may have been NH_4Cl leached from tuffs in the adjacent Superstition Mountains, subsequently oxidized to nitrate and deposited in abandoned channels of the braided-stream complex. At present, it is not possible to make a definitive choice among the possible nitrate sources. (Sims-ISWS)
W80-05748

TRACE-ORGANICS BIODEGRADATION IN AQUIFER RECHARGE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. E. Rittmann, P. L. McCarty, and P. V. Roberts.
Ground Water, Vol 18, No 3, p 236-243, May-June 1980. 8 Fig, 2 Tab, 29 Ref.

Descriptors: *Biodegradation, *Organic compounds, *Groundwater, *Artificial recharge, *Model studies, Mathematical models, On-site investigations, Injection wells, Sewage effluents, Sewage treatment, Observation wells, Chemical oxygen demand, Pollutants, Water pollution, Path of pollutants, Trace organics.

The low organic concentration and high specific surface area that characterize groundwater recharge environments allow biofilms to predominate microbial kinetics. Consideration of the kinetics of substrate utilization and growth of biofilms indicated that microbiological activity occurs very near the injection well. The aggregate substrate expressed, for example, as chemical oxygen demand, can be considered the primary substrate; the biofilm's growth is supported through the utilization of the aggregate primary substrate. Individual trace organic compounds, none of which could support biofilm growth alone, were utilized as secondary substrates. Although biodegradable, secondary substrates that have slow utilization kinetics will pass through the biologically active zone undegraded. Field data from the groundwater recharge project in Palo Alto, California, illustrated that naphthalene and heptaldehyde are biodegraded, while other compounds, such as chloroform and chlorobenzene, pass through the biologically active zone without biodegradation. (Sims-ISWS)
W80-05749

SEDIMENT-WATER CHEMICAL EXCHANGE IN THE COASTAL ZONE TRACED BY IN SITU RADON-222 FLUX MEASUREMENTS,
North Carolina Univ. at Chapel Hill. Marine Sciences Program.
For primary bibliographic entry see Field 2L.
W80-05765

SESTON DYNAMICS IN SOUTHERN APPALACHIAN STREAMS: EFFECTS OF CLEAR-CUTTING,
Georgia Univ., Athens. Dept. of Entomology.
For primary bibliographic entry see Field 4C.
W80-05770

NUTRIENT DISTRIBUTIONS IN THE CANADIAN ARCHIPELAGO: INDICATORS OF SUMMER WATER MASS AND FLOW CHARACTERISTICS,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 2L.
W80-05771

DISTRIBUTION OF NITROGENOUS COMPOUNDS IN A SMALL LAKE,
Gumma Inst. of Public Health, Maebashi (Japan).
For primary bibliographic entry see Field 2H.
W80-05780

DISCUSSION OF THE TURBIDITY MAXIMUM IN PARTIALLY MIXED ESTUARIES,
Dartmouth Coll., Hanover, NH. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2L.
W80-05790

REGIONAL INFERENCES BASED ON WATER QUALITY MONITORING DATA,
Wisconsin Univ.-Madison. School of Business.

R. B. Miller, W. Bell, R. Y-Y Wang, and O. Ferreiro.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-199698, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin Technical Report WIS WRC 80-05, 1980. 102 p, 26 Fig, 29 Tab. OWRT B-103-WIS(2), 14-34-0001-8053.

Descriptors: *Water quality, *Monitoring, Data collections, *Regional analysis, Water temperature, *Powerplants, Lake Michigan, Analytical techniques, *Heated water, Path of pollutants, Streamflow, Flow rates, Time series analysis.

High-frequency temperature variations were measured at seven depths, from the water surface to 3 m, at a point 130 m from the cooling-water outfall of a power plant on Lake Michigan. The data are analyzed using spectra, correlation functions, and probability distributions. The sharp thermal fronts observed in the data are related to the surface thermal fronts seen using airborne infrared scanning, and to laboratory studies of instabilities in mixing layers between uniformly flowing and quiescent fluids.
W80-05797

THE EFFECTS OF RAINFALL RUNOFF ON TWO UNDEVELOPED TROPICAL BAYS IN ST. JOHN, U.S. VIRGIN ISLANDS,
Caribbean Research Inst., St. Thomas. Water Resources Research Center.
T. W. Purcell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202625, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 5, June 1980. 47 p, 23 Fig, 16 Ref. OWRT A-008-VI(1), 14-34-7100.

Descriptors: *Runoff, *Rainfall runoff relationships, *Nutrient loading, Estuaries, Bays, Tropic, Tropical bays, Development, Plankton, Productivity, U.S. Virgin Islands, *St John(VI).

Two undeveloped bays in St. John, U.S. Virgin Islands were sampled during a one-year period from December 1977 through November 1978. Rainfall and runoff were measured for each of the watersheds and salinity, temperature, nutrient and plankton data were collected for the bay waters. The runoff into the bay was calculated and its effect assessed in the light of the ecological parameters measured.
W80-05799

FUTURE WATER QUALITY MONITORING PRIORITIES FOR THE TRUST TERRITORY OF THE PACIFIC ISLANDS,
Guam Univ., Agana. Water Resources Research Center.
For primary bibliographic entry see Field 6A.
W80-05803

STREAM SURVEILLANCE AND ANALYSIS: SHABAKUNK CREEK AND LITTLE BEAR BROOK WATERSHEDS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., A. W. McIntosh, and J. V. Hunter.
Mercer County 208 Water Quality Planning Program, Findings and Prelinminary Recommendations, April 1980, 85p. 19 Fig, 12 Tab, 26 Ref, 5 Append.

Descriptors: *Biological degradation, *Water pollution sources, *Water pollution effects, *Water pollution control, *Heavy metals, Oil pollution, Organic wastes, Aquatic algae, Aquatic insects, Coliforms, Lead, Sediments, Storm runoff, Benthic fauna, Algae, New Jersey, *Runoff pollution, *Stream surveillance, Nonpoint sources, *Shabakunk Creek(NJ), Little Bear Brook(NJ).

Surveillance was conducted on two Mercer County, New Jersey, Streams: Shabakunk Creek and Little Bear Brook. Although there are no known point sources entering the Shabakunk, sections of the creek below developed areas are in poor biological condition, with only a few small fish and pollution-tolerant groups of benthic macroinvertebrates present. Water quality analyses indicated that fecal coliform counts often exceed the state standard of 200/100 ml for FW-2 waters. Higest heavy metal concentrations were found in scrapings from riffles below the most developed areas. The presence of stormwater runoff and illegal discharges remains a serious problem, particularly along the West Branch, and threatens the use of Colonial Lake, a small downstream recreational reservoir. Little Bear Brook, a small stream virtually devoid of fish life, apparently receives sewage contamination from nearby residential areas. In addition, hazardous organic compounds used at several industries in the drainage basin may have entered the brook in the past. Control of both these sources of pollution to the system should be implemented immediately. (Whipple-New Jersey)
W80-05812

FACTORS AFFECTING SALINITY REDUCTION IN LAKE TARPON, PINELLAS COUNTY, FLORIDA,
Southwest Florida Water Management District, Brooksville.
P. M. Dooris, and L. F. Bartos.
Water Resources Bulletin, Vol 16, No 2, p 203-206, April 1980. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Lakes, *Salinity, *Florida, Saline lakes, Saline water intrusion, Chlorides, Chemicals, Sampling, Model studies, Mathematical models, Water supply, Rainfall, Runoff, Groundwater, Structures, Effects, Water quality, *Lake Tarpon(FL), Salinity reduction, Potability prediction.

Following an enclosure of a sinkhole connecting Lake Tarpon to the Gulf of Mexico, the chloride concentration of lake waters decreased. Water and chloride budgets for the lake in 1975 were prepared, and predictions using the model of Lerman and Brunskill were made as to the time required for the lake to achieve freshwater status. Model verification indicated good agreement with predictions in 1976; however, data on Cl(-) for 1977 and 1978 were not as supportive of the model used. The information concerning the Lake Tarpon watershed provided by this latter fact was discussed. (Sims-ISWS)
W80-05819

THE SEDIMENTS OF PRESQUE ISLE HARBOR, LAKE SUPERIOR,
Northern Michigan Univ., Marquette. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W80-05832

TWO-DIMENSIONAL HEATED JETS IN SHALLOW WATER,
Iowa Univ., Iowa City.
B. McEnroe, and S. C. Jain.
Journal of the Energy Division, American Society of Civil Engineers, Vol 106, No EY1, Proceedings Paper 15349, p 33-44, April 1980. 6 Fig, 5 Ref, 2 Append.

Descriptors: *Thermal pollution, *Shallow water, *Stratification, *Model studies, Mathematical models, Temperature, Water temperature, Circulation, Water circulation, Flow, Cooling water, Powerplants, Lakes, Reservoirs, Jets Hydraulics, Cooling systems.

The flow field induced by a two-dimensional heated jet in shallow stagnant water was analyzed. The governing partial differential equation was reduced to ordinary differential equations by integrating over the depth with assumed distributions of temperature and velocity. A multiple regression analysis applied to numerical results yielded simple expressions for the near-field dilution and the far-field length of the surface layer. A few experiments were conducted that guided the mathematical analysis. A reasonable agreement was obtained between the experimental results and numerical calculations. (Sims-ISWS)
W80-05839

ACCURACY OF HARBECK DIAGRAM FOR FORCED EVAPORATION,
Espey, Huston and Associates, Inc., Austin, TX.
G. H. Ward, Jr.
Journal of the Energy Division, American Society of Civil Engineers, Vol 106, No EY1, Proceedings Paper 15309, p 23-31, April 1980. 3 Fig, 1 Tab, 5 Ref, 1 Append.

Descriptors: *Evaporation, *Cooling waters, Model studies, Mathematical models, Temperature, Water temperature, Winds, Heat, Heat transfer, Heat budget, Powerplant, Reservoirs, Thermal pollution, Harbeck diagram, Forced evaporation, Cooling systems.

The Harbeck Diagram, a method for estimating the forced evaporation from a cooling pond, gives the fraction of heat load dissipated by evaporation as a function of wind speed and natural (unloaded) water surface temperature. The derivation of the diagram was presented, emphasizing the approximations that permit suppression of the temperature excess as an independent variable. The error in the diagram results from these approximations, increasing as the temperature excess incrases, and from inaccuracy in the estimate of the natural surface temperature. The magnitude of the error was presented as a function of wind speed and surface temperature. The accuracy of the diagram was shown to be satisfactory for ordinary engineering purposes; however, in order to relate the evaporative heat-flux fraction to forced evaporation (by multiplying by the power-plant heat load) the condition is required that the heat load be dissipated completely to the atmosphere, thus that the thermal structure be equilibrated. (Sims-ISWS)
W80-05840

DENSITY CURRENTS IN SIDEARMS OF COOLING PONDS,
Iowa Univ., Iowa City, Inst. of Hydraulic Research.
S. C. Jain.
Journal of the Energy Division American Society of Civil Engineers, Vol 106, No EY1, Proceedings Paper 15320, p 9-21, April 1980, 6 Fig, 7 Ref, 2 Append.

Descriptors: *Cooling water, *Heat transfer, *Reservoirs, *Model studies, *Mathematical models, Temperature, Water temperature, Lakes, Thermal pollution, Thermal powerplants, Flow, Currents(Water), Water circulation, Density, Cooling lakes, Cooling systems, Lake sidearms.

The design of cooling ponds for dissipating the water heat from stream electric power plants requires the determination of the amount of surface heat loss from the sidearms. The similarity solutions for the velocity and temperature distributions in a sidearm of a cooling pond were derived. The derivations of rate of heat loss and rate of flow in the sidearm were presented. The analysis was compared with the numerical results, and the agreement between the two results was found to be satisfactory. (Sims-ISWS)
W80-05841

PERFORMANCE OF POWER PLANT COOLING LAKES IN POLAND,
Institute of Meteorology and Water Management, Warsaw (Poland). Water Management Div.
M. Gadkowski, and B. A. Tichenor.
Journal of the Energy Division, American Society of Civil Engineers, Vol 106, No EY1, Proceedings Paper 15326, p 1-8, April 1980, 5 Fig, 5 Tab, 3 Ref, 1 Append.

Descriptors: *Powerplants, *Cooling water, Lakes, *Heat transfer, Thermal powerplants, Electric powerplants, Heat, Temperature, Thermal pollution, On-site investigations, Reservoirs, Storage, Cooling, Meteorology, *Poland, Cooling, Meteorology, *Poland, Cooling lakes, Cooling systems.

Poland's Institute of Meteorology and Water Management conducted a study to determine the effec-

tiveness of cooling lakes in dissipating the waste heat from steam electric generating stations. The study was conducted at two locations: (1) the Konin Lake complex, which consists of five lakes with a total surface area of 12.35 sq km to provide cooling for two power plants with a total electrical capacity of 1783 MWe; and (2) Rybnik power station (800 MWe), which uses an impoundment of the Ruda River with a surface area of 4.65 sq km. Meteorological and power plant operating data were collected and analyzed to determine the rate of heat exchange at the colling lake surface. Over an annual cycle, the rate of heat exchange for both locations was aproximately 16 kcal/sq m-hr-deg C. The values determined for the Polish locations compared favorably with empirical data reported in the technical literature. (Sims-ISWS)
W80-05842

THE STUDY OF A NATURAL HYPERSALINE LAGOON IN A DESERT AREA (THE BARDAWIL LAGOON IN NORTHERN SINAI),
Israel Oceanographic and Limnological Research Inst., Haifa. Dept. of Chemistry.
For primary bibliographic entry see Field 2L.
W80-05851

WATER QUALITY ANALYSIS OF THE HALIFAX RIVER, FLORIDA,
CH2M HILL, Inc., Gainesville, FL.
J. E. Scholl, J. P. Heaney, and W. C. Huber.
Water Resources Bulletin, Vol 16, No 2, p 285-293, April 1980. 6 Fig, 3 Tab, 20 Ref.

Descriptors: *Water quality, *Estuaries, *Simulaton analysis, *Model studies, *Florida, Mathematical models, Tidal waters, Runoff, Storm runoff, Urban runoff, Waste water disposal, Pollutants, Dissolved oxygen, Nitrogen, Phosphorus, Tidal effects, Tides, Coasts, *Halifax River(FL).

An application of the receiving water block of the EPA Storm Water Management Model (SWMM) was presented to quantify water quality impacts and evaluate control alternatives for a 208 areawide wastewater management plan in Volusia County, Florida. The water quality impact analyses were conducted for dry- and wet-weather conditions to simulate dissolved oxygen (DO), chlorides, total nitrogen (TN), and total phosphorus (TP) in the Halifax River, Florida, a 40-kilometer-long tidal estuary located on the Atlantic coast of Florida near Daytona Beach. Dry-weather analysis was performed using conventional 7-day, 10-year low flow conditions to determine a set of unit transfer coefficients which estimate the pollutant concentration transferred to any point in the estuary from a constant unit discharge of pollutants at the existing wastewater treatment plant outfall locations. Wet-weather analysis was performed by continuous simulation of a typical 3-month summer wet season in Florida. Three-month cumulative duration curves of DO, TN, and TP concentrations were constructed to estimate the relative value of controlling urban runoff or wastewater treatment plant effluent on the Halifax River. The 3-month continuous simulation indicated that the greatest change in DO, TN, and TP duration curves is possible by abatement of wastewater treatment plant pollution. (Sims-ISWS)
W80-05856

LEACHATE PLUMES IN GROUND WATER FROM BABYLON AND ISLIP LANDFILLS, LONG ISLAND, NEW YORK,
Geological Survey Syosset, NY. Water Resources Div.
G. E. Kimmel, and O. C. Braids.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.50. Geological Survey Professional Paper 1085, 1980. 38 p, 19 Fig, 3 Plates, 17 Tab, 34 Ref.

Descriptors: *Landfills, *Water pollution sources, *Malenclaves, *Path of pollutants, *Groundwater movement, Leachate, Model studies, Data collections, Sampling, Water wells, Aquifer characteristics, Chemical analysis, Mapping, Travel time, Evaluation, New York, *Suffolk County(NY), *Long Island.

Landfills operated by the towns of Babylon and Islip in southwest and central Suffolk County, N.Y., contain urban refuse incinerated garbage, and scavenger (cesspool) waste; some industrial refuse is deposited at the Babylon site. The Islip landfill was started in 1933, the Babylon landfill in 1947. The landfills are in contact with and discharge leachate into the highly permeable upper glacial aquifer (hydraulic conductivity 190 and 500 ft/d). The aquifer is 74 feet thick at the Babylon landfill and 170 feet thick at the Islip landfill. The leachate-enriched water occupies the boundaries retard downward migration of the plumes to deeper aquifers. The Babylon plume is 1,900 feet wide at the landfill and narrows to about 700 feet near its terminus 10,000 feet from the landfill. The Islip plume is 5,000 feet from the landfill. Hydrochemical maps and sections show the distribution of the major chemical constituents of the plumes. The most highly leachate-enriched ground water obtained was from the Babylon site; it contained 860 mg/L sodium, 110 mg/L potassium, 565 mg/L calcium, 100 mg/L magnesium, 2,7000 mg/L bicarbonate, and 1,300 mg/L chloride. Simulation of the movement and dispersion of the Babylon plume with a mathematical dispersion model indicated the coefficient of the longitudinal dispersion to be about 60 feet squared per day and the ground-water velocity to be 1 ft/d. However, the velocity determined from the hydraulic gradient and public-supply wells in the area was 4 ft/d, which would cause a plume four times as long as that predicted by the model. (Kosco-USGS)
W80-05881

FORD MOTOR COMPANY V. EPA: THE SIXTH CIRCUIT MUDDIES THE WATER IN THE REGULATION OF POLLUTION CONTROL METHODOLOGY,
For primary bibliographic entry see Field 6E.
W80-05888

GUIDELINES FOR CALIBRATION AND APPLICATION OF STORM,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2A.
W80-05930

AGRICULTURAL RUNOFF DURING A DROUGHT PERIOD,
Science and Education Administration, Lincoln, NE.
J. S. Schepers, E. J. Vavricka, D. R. Andersen, H. D. Wittmuss, and G. E. Schuman.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 711-719, April 1980. 3 Fig, 7 Tab, 30 Ref.

Descriptors: *Agricultural runoff, *Droughts, *Sediments, *Water quality, Nitrogen, Nutrients, Fertilizers, Herbicides, Phosphorus, Chemical oxygen demand, Crops, Rainfall, Precipitation(Atmospheric), Erosion, Runoff, Water pollution, Water pollution sources, Coliforms, Agricultural watersheds, Agriculture.

Runoff from the Dee Creek watershed over a 3-year period with less than normal precipitation amounted to less than 2% of the incoming moisture, and sediment losses were less than 0.7 meteric ton/ha per year because of the drought conditions. Nutrient losses associated with the sediment averaged 74-76% of the total N and P losses, respectively. Fertilizer application was not consistently related to nutrient losses. These data agree with those from other studies and suggest that nutrient discharge is highly dependent on sediment loss. Over 90% of runoff water samples exceeded recommended water quality standards for recreation for total coliforms and fecal coliforms, while base flows exceeded the same standards 90% of the time for total coliforms and 45% of the time for fecal colfiforms. (Sims-ISWS)
W80-05933

A FIELD STUDY OF BRINE DRAINAGE AND OIL ENTRAINMENT IN FIRST-YEAR SEA ICE,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 2C.
W80-05937

AQUEOUS-AND SEDIMENT-PHASE NITROGEN YIELDS FROM FIVE SOUTHERN PINE WATERSHEDS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
J. D. Schreiber, P. D. Duffy, and D. C. McClurkin.
Soil Science Society of American Journal, Vol 44, No 2, p 401-407, March-April 1980. 7 Fig, 5 Tab, 28 Ref.

Descriptors: *Nitrogen, *Sediments, *Watersheds(Basins), *Sampling, On-site investigations, Nitrates, Ammonia, Nitrogen compounds, Forests, Pine trees, Forest watersheds, Storm runoff, Erosion, Sediment yield, Precipitation(Atmospheric), Rainfall, Chemistry of precipitation, Nutrients, Water quality, Hydrology.

Nitrogen (N) in solution and associated with suspended sediments in stormflow from five reforested watersheds (1.5-2.8 ha) in northern Mississippi was determined during the 1975 water year. Sample were collected using Cohocton wheel samples set below 0.91-m H-flumes. Mean yearly solution NH4-N and NO3-N concentrations, 0.20 and 0.01 mg/liter, respectively, did not differ among watersheds. Sediment-N concentrations ranged from 2410 to 6080 micrograms/gram and were 5.4 to 10.0 times those in the watershed soils. The N enrichment of sediment relative to soil was attributed to selective erosion of fine sediments (clay) and/or deposition of coarse sediments in transport. Significant differences in sediment N yields among the five watersheds were related to stormflow volume, sediment concentration, and sediment N concentration. Nitrogen was transported from the watersheds about equally in the sediment and solution phases. Mean solution NH4-N and NO3 yields for the water year were 422 and 28 g/ha, respectively, for the five watersheds; mean sediment N yield was 3915 g/ha. For the year, 8-17% of the precipitation was measured as stormflow; the remainder was deep seepage and evapotranspiration since there was deep seepage and evapotranspiration since there was essentially no baseflow. (Sims-ISWS)
W80-05939

ROAD SALT MOVEMENT INTO TWO TORONTO STREAMS,
Ontario Hydrology, Toronto. Dept. of Transmission Environment.
For primary bibliographic entry see Field 4C.
W80-05942

LOW FLOW AND STORMWATER QUALITY IN URBAN CHANNELS,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5A.
W80-05943

STORMWATER DETENTION IN DEVELOPING WATERSHEDS,
Espey-Huston and Associates, Inc., Houston, TX.
For primary bibliographic entry see Field 2E.
W80-05944

WATER POLLUTION FROM SNOW REMOVAL OPERATIONS,
SEA Inc., Rochester, NH.
For primary bibliographic entry see Field 4C.
W80-05945

MODELING STORM OVERFLOW IMPACTS ON EUTROPHIC LAKE,
Limno-Tech, Inc., Ann Arbor, MI.
P. L. Freedman, R. P. Canale, and J. F. Pendergast.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE2 Proceedings Paper 15355, p 335-349.

April 1980, 7 Fig, 2 Tab, 21 Ref, 1 Append.

Descriptors: *Lakes, *Water pollution, *Pollutants, *New York, *Model studies, Mathematical models, Combined sewers, Storm runoff, Water quality, Biochemical oxygen demand, Dissolved oxygen, Nitrogen, Phosphorus, Coliforms, Water circulation, Mixing, Path of pollutants, *Onondaga Lake(NY).

A mathematical model was developd to predict the transient impact of storm loads on phosphorus, fecal coliform, and dissolved oxygen concentrations in Onondage Lake and to determine the need for control of storm overflows. Model simulations demonstrated that combined sewer and storm loads have a significant impact on lake fecal coliform but little effect on phosphorus, CBOD, NBOD, and dissolved oxygen in Onondage Lake. Observed variations in lake dissolved oxygen were caused by canges in chlorophyll a, light, and wind. Control of storm loads is recommended to alleviate violations of fecal coliform water quality standards but not for improvement of dissolved oxygen concentrations. As a consequence of the modeling analysis, a limited control program for combined sewer overflows was signed which included only disinfection and removal of objectionable solids. Reductions in storm loads of nutrients and BOD would not provide any significant improvements in lake water quality and were not recommended. (Sims-ISWS)
W80-05946

OCEAN OUTFALL DILUTION: EFFECTS OF CURRENT,
Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering.
P. J. W. Roberts.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Proceedings Paper 15429, p 769-782, May 1980, 13 Fig, 5 Ref, 2 Append.

Descriptors: *Outfall sewers, *Currents(Water), *Waste dilution, *On-site investigations, *Model studies, Mathematical moels, Ocean currents, Dispersion, Mixing, Sewage disposal, Coastal engineering, Pollutants, Path of pollutants, Water pollution, Tides, Tidal effects, *San Francisco(CA).

Analyses of data for the City of San Francisco, California, obtained from continuously recording current meters showed the most energetic current component, the first principal component, to be strongly tidal and to lie along an axis pointing approximately to the Golden Gate. The diffusers were placed perpendicular to this component, where possible, to obtain the maximum beneficial effect of the currents on dilution. A mathematical model was applied to the proposed diffusers to predict dilution in the presence of currents, using measureed oceanic conditions. Results showed the dilution and wastefield rise height to vary widely due to the varying oceanic and discharge conditions. The median dilutions were found to depend on season and to be increased substantially over those predicted neglecting the dymanic effect of currents on dilution. The effect of diffuser orientation was also investigated with the model, and it was found that suitable orientation to the prevailing currents can significantly affect the initial dilution. (Sims-ISWS)
W80-05952

GROUND-WATER POLLUTION BY SEPTIC TANK DRAINFIELDS,
Washington Univ., Seattle. Dept. of Environmental Health.
For primary bibliographic entry see Field 5A.
W80-05958

RIVER NUTRIENT AND CHEMICAL TRANSPORT ESTIMATION,
West Virginia Univ., Morgantown. Dept. of Chemical Engineering.
F. H. Verhoff, S. M. Yaksich, and D. A. Melfi.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE3, Proceedings Paper 15456, p 591-608, June 1980. 4 Fig, 5 Tab, 15 Ref, 2 Append.

Descriptors: *Path of pollutants, *Nutrients, *Rivers, *Lake Erie, *Estimating equations, Mathematical models, Model studies, Watersheds(Basins), Sediments, Sediment transport, Phosphorus, Chemicals, Water quality, Water pollution, Water pollution sources.

This paper presented calculational methods for estimating the river flux of materials wehn continuous flow records and little concentration data are available. These methods are especially applicable to materials whose concentration is a function of flow rate (most substances). They were applied to total phosphorus and suspended sediment in the rivers of the Lake Erie basin and compared with previous methods of estimation. Total phosphorus is an important pollutant to Lake Erie because much of this particulate material can be converted to a soluble form and utilized by the algae in the lake. Thus, the estimation methods were applied extensively to Lake Erie river basins. The calculated total phosphorus effluxes were compared between river basins on a unit area basis. The results indicated a large variability of unit area loadings, even for river basins that are very similar. (Sims-ISWS)
W80-05959

5C. Effects Of Pollution

PHYSIOCOCHEMICAL FACTORS AND THEIR EFFECTS ON ALGAL GROWTH IN A NEW SOUTHERN CALIFORNIA RESERVOIR,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. F. Elder, R. H. Fuller, and A. J. Horne.
Water Resources Bulletin, Vol 15, No 6, p 1608-1617, December 1979. 5 Fig, 2 Tab, 27 Ref.

Descriptors: *Physicochemical properties, *Effects, *Eutrophication, California, *Reservoirs, Lakes, Nutrients, Nitrogen, Phosphorus, Iron, Cyanophyta, Phytoplankton, Biomass, Algae, Mixing, Sedimentation, Stratification, *Southern California, Lake Perris(CA).

Some physical and chemical characteristics of Lake Perris, a new southern California reservoir, were investigated with regard to their influence on phytoplankton biomass and community structure. The concentration ratios of three major nutrients--nitrogen, phosphorus, and iron--were approximately equivalent to the demand ratio of freshwater plants. Large increases in iron and phosphorus concentrations in late summer due to releases from sediments, however, were likely to shift the balance toward a nitrogen-limited situation. Nitrogen limitation favored nitrogen-fixing blue-green algae, and after a decline of competing algae during the summer the blue-green algae bloomed in September. Series of measurements taken over one-day periods during summer stratification showed that some iron, phosphorus, and manganese from the hypolimnion could move upward, corresponding to diel shifts in the thermocline depth. Vertical transport of nutrients could thus occur long before complete lake mixing, and could support summer/fall algal blooms. (Kosco-USGS)
W80-05720

NEARSHORE IMPACT OF STORMWATER IN LAKE SAMMAMISH, WASHINGTON,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. B. Welch, and M. A. Perkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-199953, Price codes: A05 in paper copy, A01 in microfiche. Final Report, March 1980. 71 p, 16 Fig, 11 Tab, 35 Ref. OWRT B-068-WASH(1). 14-34-0001-7198.

Descriptors: *Storm runoff, *Algae, *Washington, *Eutrophication, Nutrients, Mesotrophy, Water quality, Urban runoff, Plant growth, Drainage water, Chlorophyll, Phosphorus, Drainage, Nitrogen, Suspended solids, Lake stages.

The enriching and/or inhibitory effects of stormwater entering the western nearshore of Lake Sammamish on periphytic algal growth in the shallow area and on the lake as a whole was studied from 1976 - 1979. Lake Sammamish is located 20 km east of Seattle, Washington. It has a surface area of 19.8 sq km, with a mean depth of 17.7 m. Lake Sammamish is upper mesotrophic with typical chlorophyll a and phosphorus concentrations for such a trophic state. The western shore was selected as the study site due to the extensive development of the area. Runoff from three subdrainages was used. The runoff from these subdrainages flows through concrete pipes and enters the lake at the shoreline. Both manual and automatic sampling was used. Results show that enhancement of periphytic algae does occur, however, the area effected is small and total potential is not realized due to toxic inhibitors in the stormwater. During wet-weather flow, the concentrations of nutrients and metals were higher by a factor of 2.5 than during dry-weather flow. Overall the impact of continued development and the resulting increase in stormwater runoff appears to be more significant to the total lake's trophic state than to a local area. Six growth potential experiments conducted with selenastrium capricornutum indicated that phosphate input from the stormwater sources could stimulate algal growth in 0.9% of the lake. (Seigler-IPA)
W80-05750

TOXICOLOGICAL APPRAISAL OF HALOGENATED AROMATIC COMPOUNDS FOLLOWING GROUNDWATER POLLUTION.
World Health Organization, Copenhagen (Denmark). Regional Office for Europe.
Report on a WHO Working Group, 1980, 62 p, 2 Fig, 5 Tab, 73 Ref, 4 Append.

Descriptors: *Toxicity, *Public health, *Water pollution effects, *Organic compounds, Environmental effects, Human pathology, Lethal limit, Pesticides, Safety, Chemicals, Chemical wastes, Aromatic compounds, Phenols, Water pollution.

Guidelines for the use of halogenated aromatic compounds were developed by a group of 13 experts from 11 countries and other representatives and authorities at a conference in Venice, in September 1979. The meeting was convened at short notice in response for guidance from the government of the Vicenzo Province where groundwater pollution had been caused by process residues percolating from an effluent lagoon. At the meeting available data were reviewed on the chemistry, environmental occurrence, and toxicology of halogenated toluenes, benzenes, and phenols. Possible health hazards associated with human expose to these chemicals in the environment were also explored. The pollutants were grouped as halogenated toluenes, halogenated benzenes and anilines, and chlorophenols. A review of information is given for each of these groups followed by a health hazard data assessment. Practical aspects of pollution monitoring and control are also discussed. The conference endorsed the decision of the Vento Regional Government to terminate the use of contaminated groundwater for public use. It is recommended that a mechanism be established whereby in the case of future accidents, ad hoc groups of international experts could be brought together to provide guidance. Despite these after the fact actions, the underlying philosophy must be the prevention of such incidents. (Seigler-IPA)
W80-05755

HETEROTROPHIC BACTERIA IN TWO CANADIAN RIVERS--I. SEASONAL VARIATIONS IN THE PREDOMINANT BACTERIAL POPULATIONS,
New Brunswick Univ., Fredericton. Microbiology Research Lab.
C. R. Bell, M. A. Holder-Franklin, and M. Franklin.
Water Research, Vol 14, No 5, p 449-460, 1980. 8 Fig, 7 Tab, 55 Ref.

Descriptors: *Rivers, *Bacteria, *Nutrients, *Water temperature, *Canada, Sampling, Biological communities, Oxygen, Dissolved oxygen, Nitrogen, Nitrogen compounds, Phosphorus, Chlorophyll, Ice cover, Seasonal, Water quality, On-site investigations, *Meduxnekeag River(NB), *Dunbar River(NB).

The indigenous heterotrophic bacteria in the water of two contrasting rivers have been examined over a period of 1 year. Both rivers appear to be oligotrophic, although one, the Meduxnekeag, receives domestic and industrial effluent. The bacterial populations appear to be limited by nitrogen and appear to be almost exclusively psychrotrophic in both rivers. The bacterial species were identified by numerical taxonomy and were found to be predominantly fluorescent Pseudomonas spp. Estimates of in situ heterotrophic activity were influenced mainly by temperature. Both rivers were ice covered for 5 months, and thus the activities were comparable. Nitrate dissimilation was the major increasing activity under this ice cover. (Sims-ISWS)
W80-05781

EFFECTS OF MODERATE SEWAGE INPUT ON BENTHIC POLYCHAETE POPULATIONS,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2L.
W80-05783

DAILY, SEASONAL, AND ANNUAL FLUCTUATIONS AMONG ZOOPLANKTON POPULATIONS IN AN UNPOLLUTED TROPICAL EMBAYMENT,
Harbor Branch Foundation, Fort Pierce, FL.
For primary bibliographic entry see Field 2L.
W80-05788

DYNAMICS OF PHYTOPLANKTON PRODUCTIVITY IN THE PECONIC BAY ESTUARY, LONG ISLAND,
New York Ocean Science Lab., Montauk.
For primary bibliographic entry see Field 2L.
W80-05789

STREAM SURVEILLANCE AND ANALYSIS: SHABAKUNK CREEK AND LITTLE BEAR BROOK WATERSHEDS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 5B.
W80-05812

RELATIONSHIPS BETWEEN METABOLIC PARAMETERS AND STREAM ORDER IN OREGON,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 2K.
W80-05813

BENTHIC AND ATMOSPHERIC CONTRIBUTIONS TO THE NUTRIENT BUDGETS OF A SOFT-WATER LAKE,
Connecticut Univ., Storrs. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2H.
W80-05833

A COMPARISON OF METHODS AND INSTRUMENTATION OF BIOLOGICAL EARLY WARNING SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. Cairns, Jr., and D. Gruber.
Water Resources Bulletin, Vol 16, No 2, p 261-266, April 1980. 1 Tab, 30 Ref.

Descriptors: *Monitoring, *Water quality, *Bioindicators, *Fish, Computers, Equipment, Instrumentation, Sampling, Automation, Biology, Electronics, Electronic equipment, Water pollution, Water pollution effects, Biological warning systems.

Rapid biological information systems using aquatic organisms to monitor water and wastewater quality have only recently begun to develop technologically for practical on-site applications. One approach which has been demonstrating its feasibility recently monitors the ventilatory behavior of fish to assess, for example, the quality of drinking water supplies and industrial wastewater discharges. A comparison of the basic strategies of the various biological monitoring systems making use of this concept was presented. In addition, the applications and potential utilization of these systems were discussed. (Sims-ISWS)
W80-05858

THERMAL RESISTANCE CHARACTERISTICS OF EARLY LIFE HISTORY STAGES OF FINFISH FROM LONG ISLAND WATERS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
C. F. Smith,, J. R. Schubel, M. P. Greges, N. Itzkowitz, and S. J. DiPiero.
Special Report 26, Reference 79-9, July 1979. 70 p, 37 Fig, 15 Tab, 11 Ref.

Descriptors: *Thermal stress, *Thermal pollution, *Resistance, *Growth stages, Fish eggs, Larval growth stage, Temperature, Stress, Temperature control, Environmental effects, Water pollution effects, Data processing, Genetics, New York, *Long Island(NY), *Finfish.

Eggs and larvae of finfish from Long Island, New York, waters were subjected to elevated temperatures simulating the thermal stresses experienced by organisms near power plants with once-through cooling systems. From these data, 10, 50, and 90% mortality thermal resistance curves were drawn for weakfish scup, striped searobin, blackfish, and summer flounder. The eggs were artificially fertilized onboard commercial fishing vessels and transfered in insulated containers to an aerated constant temperature bath system. Experiments were carried out in smaller baths and the time and temperature, maintained for a specific period of time, and (3) immediate cooling in constant temperature bath temperature. Criteria for the death of an organism was critical: (1) opaque coloring of the anterior portion of the embryo or larvae and (2) cessation of heartbeat. Thermal resistance curves were produced by computer and each curve had two areas, one of negative slope which indicates resistance, and one of the zero slope which indicates tolerance. Summer flounder late embryo eggs and weakfish late tail-free embryo eggs showed the best thermal resistance. Thermal resistance was found to be a function of the life history stage. An increase in thermal resistance accompanied an increase in age and increase in acclimation temperature. The variation in responses of similarly acclimated organisms decreased as the thermal stress was increased. Genetic factors may also influence thermal resistance. (Sidney-IPA)
W80-05863

CONTIGUOUS ZONES OF POLLUTION PREVENTION,
Ottawa Univ. (Ontario).
For primary bibliographic entry see Field 6E.
W80-05895

ACUTE TOXICITY OF A NUMBER 6 FUEL OIL TO MARINE ORGANISMS,
EG and G Bionomics, Pensacola, FL. Marine Research Lab.
T. A. Hollister, G. S. Ward, and P. R. Parrish.
Bulletin of Environmental Contamination and Toxicology, Vol 24, No 5, p 656-661, May 1980. 1 Tab, 3 Ref.

Descriptors: *Water pollution effects, *Toxicity, *Oil pollution, *Oil spills, Environmental effects, Transportation, Massachusetts, Diatoms, Marine algae, Marine fish, Copepods, Testing, *Outer Continental Shelf, Fuel oil, Argo Merchant, Skeletonema costatum, Acartia tonsa, Menidia menidia.

The oil tanker Argo Merchant broke up in shoal waters off Nantucket, Massachusetts, in December 1976 and spilled at number 6 oil containing a number 2 cutter stock. The U.S. Coast Guard attempted to burn the oil slick at sea, but heavy seas contributed to an unsuccessful operation. Shortly after the spill, acute toxicity tests were performed with five test materials and three saltwater organisms--an alga, a copepod, and a fish. The test materials included a number 6 fuel oil, Tullanox 500 - a wicking agent, and lighter fluid. The materials were tested singularly and in combination. The three materials were also combined according to instructions from the U.S. Coast Guard, ignited, and the resulting residue tested. (Sinha-OEIS)
W80-05981

VERTICAL TRANSPORT OF CHLORINATED HYDROCARBONS BY SEDIMENTATION OF PARTICULATE MATTER IN KIEL BIGHT,
Kiel Univ. (Germany, F. R.). Inst. fuer Meereskunde.
C. Osterroht, and V. Smetacek.
Marine Ecology - Progress Series, Vol 2, No 1 p 27-34, February 1980. 4 Fig, 3 Tab, 34 Ref.

Descriptors: *Water pollution effects, *Sedimentation, *Polychlorinated biphenyls, Pesticides, Environmental effects, Resources development, Ships, *Outer Continental Shelf, *Kiel Bight, Western Baltic Sea, Particulate matter, Chlorinated hydrocarbons, Resources management, Vertical transport, Shipping.

Particulate matter settling out of the water column was collected continuously over a two-year period by means of multisample sediment raps in the coastal water of the Western Baltic Sea. The content of PCBs and organochlorine pesticides of this matter was determined and compared with its dry weight, and with its organic carbon, nitrogen, and plant pigment content. The pesticide content of this material was highly variable and a marked decline in absolute concentrations was present from 1975-1977; in most samples from 1977, pesticide content was below detection limit. For PCBs a distinct annual cycle was observed which was inversely related to the rates of sedimentation of seston; highest absolute values for PCBs in each year were recorded during the summer. (Sinha-OEIS)
W80-05982

EFFECTS OF THE 'AMOCO CADIZ' OIL SPILL ON THE SEAGRASS COMMUNITY AT ROSCOFF WITH SPECIAL REFERENCE TO THE BENTHIC INFAUNA,
Katholieke Ulniv., Nijmegen (NetherlandsL). Lab. Voor Aquatische Oecologie.
R. P. W. M. Jacobs.
Marine Ecology - Progress Series, Vol 2, No 3, p 207-212, April 30, 1980. 2 Fig, 3 Tab, 17 Ref.

Descriptors: *Oil spills, *Water pollution effects, *Benthic flora, *Benthic fauna, Grasses, Environmental effects, Resources development, *Outer Continental Shelf, France, Amoco Cadiz, Shipping, Zostera marina.

The benthic fauna of an eelgrass (Zostera marina L.) community has been investigated at Roscoff (France) from October 1977 to April 1979. The impact of the 'Amoco Cadiz' oil spill of March 1978 on the community was studied. Direct effects on the eelgrass itself were only local during the first weeks after the spill, when many plants had black, 'burnt' leaves. This was, however, a temporary phenomenon, for the production of new leaf tissue continued normally. Effects on the benthic fauna were observed directly after the arrival of the oil at Roscoff. A sharp decrease in numbers of both individuals and species occurred--mainly caused by an almost total disappearance of the smaller Crustacea and Echinodermata, and a serious numerical decrease in other groups. Recovery took place relatively rapidly. In the beginning of 1979 all numbers were at the same level as the year before, the filter feeding Amphipoda being the only exception: on 1 May 1979 they were still absent. (Sinha-OEIS)
W80-05983

5D. Waste Treatment Processes

MECHANISM OF OZONE INACTIVATION OF BACTERIOPHAGE F2,
Ohio State Univ., Columbus. Dept. of Civil Engi-

neering.
C. K. Kim, D. M. Gentile, and O. J. Sproul.
Applied and Environmental Microbiology, Vol 39, No 1, p 210-218, January 1980. 5 Fig, 1 Tab, 34 Ref. OWRT B-013-ME(1).

Descriptors: *Ozone, *Bacteriophage, *Viruses, *Waste water treatment, Aquatic microbiology, Public health, Water pollution sources, Enteric bacteria, Microorganisms, E. coli, Electron microscopy, Laboratory tests, Water purification.

A controlled laboratory study of the inactivation kinetics of bacteriophage f2 by ozone showed that ozone breaks the protein capsid of phage f2 into many subunits, thus liberating RNA into the solution and disrupting adsorption to the host pili. The ribonucleic acid-containing bacteriophage f2 was used in the inactivation study due to its similarity to enteric viruses. Bacteriophage f2 was propagated by using E. coli: K-13 Hfr grown in tryptone-yeast extract broth medium and the ammonium sulfate method. Following purification and titration, the RNA was labeled with (3H)uridine. The ozonation system used was constructed with stainless steel and teflon tubing with a 2-liter borosilicate glass bottle reactor. A host adsorption experiment was conducted along with the use of electron microscopy and a sucrose density gradient analysis. Results show that the phage were rapidly inactivated during the initial 5 s of exposure by 5 and 7 logs with ozone concentrations of 0.09 and 0.8 mg/liter. At both concentrations, further inactivation occurred during the next 10 min., at a slower rate. RNA enclosed in the phage coat was inactivated less by ozonation than were the whole phage. Following the breakage of the protein capsid into subunits, it appears that the RNA may be secondarily sheared by a reduction with and/or without the coat protein molecules. From these findings, it is possible that if enteric viruses are inactivated in a similar manner, their RNAs may retain their infectivities after liberation from the viral particles during ozonation in waste water treatment. (Seigler-IPA)
W80-05753

SEQUENTIAL USE OF RECLAIMED WASTEWATER DESTINED FOR AQUIFER RECHARGE,
Caribbean Research Inst., St. Thomas. Water Resources Research Center.
For primary bibliographic entry see Field 4B.
W80-05801

WATER RESOURCES FOR CHICAGO--HISTORY AND FUTURE,
Metropolitan Sanitary District of Greater Chicago, IL.
F. C. Neil, and F. E. Dalton.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 106, No WR1, Proceedings Paper 15269, p 173-184, March 1980. 5 Fig, 1 Tab, 2 Ref, 1 Append.

Descriptors: *Combined sewers, *Sewers, *Cities, *Tunnels, *Water quality, Storm runoff, Urban runoff, Sewage, Sewage treatment, Reservoirs, Water pollution, Water pollution control, Water quality control, Diversion, Diversion tunnels, Aeration, Water resources, *Chicago(IL).

Combined sewer systems in much of the Chicago area negate many of the benefits of the largest and most advanced system of water reclamation plants in the world. On an average of 100 times a year, combined sewer flows overload district interceptors and surge into the rivers at 645 different points. Occasionally, the gates from Lake Michigan have to be opened to allow the rivers to relieve themselves in the lake. The Tunnel and Reservoir Plan (TARP) will include 131.1 miles (211 km) of tunnels 150-ft to 300-ft (46-m to 91-m) below the rivers and the streets of the city. Drop shafts will intercept the flow in the combined sewers before it can reach the overflow points. The tunnels will convey this flow to reservoirs where it will be stored prior to being pumped to sewage treatment plants. Phased implementation of TARP will reduce the need for Lake Michigan water for dilution, making a larger proportion of the 3,200-cfs (90.6-cu m/s) court allocation available for domestic and industrial use in the expanding Chicago metropolitan area. (Sims-ISWS)
W80-05822

AUTOMATIC CONTROL FOR WASTEWATER TREATMENT SYSTEMS,
Ontario Ministry of the Environment, Toronto. Applied Science Section.
G. D. Zarnett.
Report No 80, January 31, 1980. 48p. 11 Fig, 2 Tab, 42 Ref.

Descriptors: *Automatic control, *Waste water treatment, *Computer models, *Optimization, *Economics, *Control systems, Monitoring, Efficiencies, Operatin and maintenance, Canada, Recycling, Sludge, Sewage effluents, Aeration, Water quality control, Chemical degradation.

Automatic control of waste water treatment plants has the advantage of improving the quality, quantity, and uniformity of the products and giving savings in energy and cost. The large variations in waste water flow and composition require either manual or automatic control of the process to achieve the optimum operating conditions. Computer control of the system frees the operator to do other tasks and it generates more consistent effluent and logs data. In designing process control systems, the mathematical representation of the system must be based on unsteady state analysis. The linear system design based on Ponryagin's Maximum Principle and the non-linear optimization by Direct Search are examples or optimal design techniques. A simple proportional feedback control allows for adjustments to be made to the system. Design parameters and matehamtical models of an aeration system, influent disturbance functions, optimal control, and control by food-to-microorganism ratio are presented for the plant at Cambridge (Galt). Recycle sludge control is used to minimize the performane index and achieve optimal control. The values of the controller gain matrix are determined by computer and then used to equilibrate the system. A non-linear model for optimum control also results in a simulation of the system and a sensitivity analysis. The low cost of computers and the facile transmission of data make automatic control of waste water treatment feasible for new and old plants. The design and efficiency of several existing control systems are described. (Sidney-IPA)
W80-05861

HYDRAULIC EFFECTS OF RECHARGING THE MAGOTHY AQUIFER, BAY PARK, NEW YORK, WITH TERTIARY TREATED SEWAGE,
Geological Survey, Syosset, NY. Water Resources Div.
J. Vecchioli, H. F. H. Ku, and D. J. Sulam.
Available from Supt. of Documents, GPO, Washington, DC. 20402, Price $2.00. Geological Survey Professional Paper 751-F, 1980. 21 p, 10 Fig, 8 Tab, 32 Ref.

Descriptors: *Artificial recharge, *Aquifers, *New York, *Tertiary treatment, *Sewage, Water reuse, Reclaimed water, Injection wells, Hydraulics, Effects, Chemical reactions, Clogging, Pumping, Specific capacity, Evaluation, Path of pollutants, *Bay Park(NY), *Magothy aquifer(NY), Well clogging.

From 1968-73, public-supply water and water reclaimed from sewage were injected into the Magothy aquifer, Long Island, N. Y., in a series of 19 recharge experiments. Injection was through a fiberglass-cased well with a 16-inch diameter stainless-steel screen set from 418 to 480 feet below land surface. Most tests ranged from 2 to 33 days; in the final test a total of 42 million gallons of water was injected intermittently for 6 months. In some tests, chlorination or other chemical treatments were applied to evaluate their effect on well clogging and to observe geochemical reactions within the aquifer. After each test, the injected water was pumped from the aquifer. Clogging developed to varying degress in the recharge well and contiguous parts of the aquifer and resulted in excessive head buildup in the well. Clogging was due primarily to suspended solids in the injected water. Microbial growth was an insignificant factor in clogging as long as a total residual chlorine level of 2 milligrams per liter was maintained. Specific capacity was restored by pumping and surging the well. Clogging materials underwent biodegradation when the well was idle. Redevelopment by pumping and surging was improved after idle periods of several weeks. (Kosco-USGS)
W80-05884

RESEARCH FOR A DRY LAND.
For primary bibliographic entry see Field 5A.
W80-05923

PROCESS FOR TREATING PARTICLES OF ADSORBENT USED TO REMOVE PHENOL FROM WASTE WATER,
Otto (C.) and Co., G.m.b.H., Bochum (Germany, F.R.). (Assignee).
U. Hahn, and K. Stumpe.
U.S. Patent No 4,177,139, 5 p, 2 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 250-251, December 4, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, Separation techniques, Adsorption, Phenols, Regeneration, Fluidized bed.

A process is described for removing phenol from waste water by suing an adsorbent which can be regenerated. The adsorbent consisting of active carbon or aluminum oxide is regenerated by removing the adsorbent from an adsorber and draining on a separator screen from where undersized particles are resized and particles having the desired size are fed into a fluidized-bed oven for regeneration after which the resized and regenerated adsorbent particles are pumped into the adsorber. Undersized adsorbent particles having a particle size less than 15% of the desired nominal particle size are recovered and processed separately. In this manner, the losses of adsorbent are reduced by 75% or more as compared with known processes to treat adsorbent particles. (Sinha - OEIS)
W80-05967

EXCESS-GROWTH CONTROL SYSTEM FOR FLUIDIZED-BED REACTOR,
Ecolotrol, Inc., Bethpage, NY. (Assignee).
R. F. Hickey, and R. W. Owens.
U.S. Patent No 4,177,144, 11 p, 11 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 252, December 4, 1979.

Descriptors: *Patents, *Waste water treatment, *Biological treatment, *Separation techniques, Equipment, Control systems, Flow velocity.

This invention relates generally to a fluidized-bed reactor in which waste water or other liquid to be processed is conducted upwardly through a bed of small carrier particles which in the course of operation are enlarged by the growth of cellular material, and more particularly, to a system for controlling the accumulation of such material. Included in the system is a separator column whose low end extends toward the fluidized bed and whose high end extends toward a head of liquid effluent which lies on the bed. In the course of reactor operation, the cellular material on the particles continues to grow, causing the bed to expand until its level reaches an alarm point indicative of excessive growth. This point is sensed to activate an agitator arrangement which effects shearing of the excess cellular material and partially stripped carrier particles. The separator column is provided with a draw-off port somewhat below the surface of the effluent head, the exit flow rate at the draw-off port being adjusted so that the resultant upward flow velocity in the separator column is lower of the sheared material. As a consequence, the sheared material is washed away through the draw-off port, whereas the partially stripped carrier particles ball back into the fluidized bed. This activity continues until the level of the bed falls to a predetermined safety point below the alarm point when the activity is discontinued to complete the

cycle which is not repeated until the bed again expands to reach the alarm point. (Sinha - OEIS)
W80-05970

BIOLOGICAL TREATING SYSTEMS,
Roberts Filter Mftg. Co., Darby, PA. (Assignee).
R. L. Roberts.
U.S. Patent No 4,177,147, 10 p, 7 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 253, December 4, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Sewage, Biological treatment, Aerobic conditions, Equipment, Aeration, Reciprocating movement.

The biological treating systems include a treating tank for receiving wastewater, and a wastewater contacting unit mounted for reciprocating movement into and out of the wastewater retained within the tank. Movement of the unit out of the wastewater exposes it to oxygen that is needed to maintain an aerobic environment for biological slimes, and movement of the unit into the wastewater permits these slimes to feed upon and metabolize pollutants therein. The wastewater contacting units are positioned in pairs on opposite sides of axles. These axles are mounted for reciprocating movement, and a drive mechanism is provided to reciprocate the axles and the connected pairs of contacting units. (Sinha - OEIS)
W80-05971

BIOLOGICAL INTERMEDIATE SEWAGE TREATMENT WITH OZONE PRETREATMENT,
Union Carbide Corp., NY. (Assignee).
F. E. Lowther.
U.S. Patent No 4,178,239, 6 p, 2 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 989, No 2, p 616, December 11, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Biological treatment, Ozone, Aerobic conditions, Microorganisms, Biodegradation, Tertiary treatment.

Overall sewage removal in an intermediate biological treatment can be improved by employing ozone treatment prior to the conventional secondary treatment. Ozone pretreatment is found to increase the BOD of sewage, making larger amounts of sewage components susceptible to biological secondary treatment under conventional aerobic conditions. The ozone pretreatment may be used in combination with an activated sludge secondary process. Air diffusion or mechanical aeration processes can benefit substantially from ozone pretreatment. The invention provides a novel process for intermediate treatment of sewage containing biodegradable materials and non-biodegradable materials wherein ozone-pretreated sewage is contacted in a secondary treatment with an O2 containing gas in the presence of aerobic microorganisms. A further object is to provide an ozoning intermediate step for contacting the sewage than an ozone-containing gas to pretreat the sewage by converting a substantial amount of the non-biodegradable material to biodegradable material. The process may also include subsequent tertiary treatment with ozone. (Sinha - OEIS)
W80-05976

PROCESS FOR REMOVAL OF HARDENING AND GALVANIZING WASTE WATER,
Deutsche Gold- und Silber-Scheideanstalt A.G., Frankfurt-am-Main (Germany, F.R.). (Assignee).
H. Kunst, and G. Wahl.
U.S. Patent No. 4,178,244, p 1, Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 989, No 2, p 617-618, December 11, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Evaporation, Oxidation, Chemical precipitation, Galvanizing processes.

Waste waters from salt bath hardening and galvanizing operations are removed through evaporation of the waste water to a concentration of 300 to 500 grams salt content per liter and then supplying this concentrated solution to a liquid (molten) salt bath. There is particularly suited salt bath based on sodium hydroxide and/or potassium hydroxide, sodium nitrate and sodium sulfate and/or potassium sulfate and which is operated at 300 deg to 500 deg C. There can also be present potassium nitrate. Cyanides and cyanates upon entry into the salt bath are oxidized quantitatively to carbonates. The heavy metals are precipitated as oxides or hydroxides and settle as sludge. The barium is likewise separated in the sludge as sulfate. The sludge of such a bath can be withdrawn without trouble by suitable apparatus besides the original bath constituents. This type of salt mixture can be stored in ground water secured separate refuse deposits without further precautions. (Sinha-OEIS)
W80-05978

FILTRATION METHOD,
Hitachi, Ltd., Tokyo (Japan). (Assignee).
A. Nakaoka, and S. Takahashi.
U.S. Patnet No 4,178,245, 6 p, 2 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 989, No 2, p 618, December 11, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Filtration, Water pollution treatment, Bubbles, Flow, Flow augmentation, Equipment.

The object of the invention is to provide a filtration method for continuous separation of suspended solids from sewage water without an interruption by preventing the blocking or clogging of the filter material by continuously removing solids attached to the inner and outer surface of the filter material during the process of filtration. The method employs a water tank, a filtration tank within the water tank provided with a filter material. A shield or guide plate encompassing the filtration tank adjacent the filter material provides a liquid flow passage. A bubble generator has openings for generating bubbles within the flow zone, so that the bubbles pass along the filter material. Sewage water that is supplied to the water tank is conducted to the flow zone where part of the water passes through the filter material and solids suspended are strained out and attached to the outer surface of the filter material. The generated bubbles passing through the flow zone create a difference in pressure between a point at which the fluid including the bubble is flowing in the water flow zone and an opposite point within the filtered water chamber of the filtration tank, dislodges the solids attached to the filter material and prevents clogging of the filter material. (Sinha - OEIS)
W80-05979

5E. Ultimate Disposal Of Wastes

INTERIM DATA REPORT ON THE GEOHYDROLOGY OF THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEAST NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-05701

5F. Water Treatment and Quality Alteration

FORMATION AND CONTROL OF TRITHALOMETHANES IN CHLORINATED DRINKING WATERS CONTAINING FULVIC ACID,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W80-05802

REMOVAL OF BACTERIOPHAGE ESCHERICHIA COLI T1 BY SAND COLUMNS USING CA(2+) AS A FILTER AID,
Auburn Univ., AL. Dept. of Civil Engineering.
S. R. Jenkins, C. A. Copperthite, J. L. Barton, and C. G. Jordan.
Water Research, Vol 14, p 437-440, 1980. 5 Fig. OWRT B-065-ALA(3), 14-34-0001-60055.

Descriptors: *Calcium, *Viruses, *Filters, *Escherichia Coli T, Virus removal, Deep model filters, Sands, Particle size, Hydrogen ion concentration.

Calcium was shown to enhance the removal of T1 coliphage by model sand columns. The concentration of calcium necessary to cause effective removal of the virus was shown to be stoichiometric with the virus titer. The effectiveness of the 2.54 cm (1 in.) i.d., 10.16 cm (4 in.) deep model filters to remove T1 coliphage in the presence of calcium was shown to decrease as the sand grain size increased. Ca is enhanced removal most effectively at slightly acid pH's. That is, more Ca is required to produce effective removal of the virus as the pH is raised.
W80-05811

EVALUATION OF STORMWATER IMPOUNDMENTS IN WINNIPEG,
Metropolitan Corp. of Greater Winnipeg (Manitoba). Water Works and Wste Disposal Div.
G. M. Chambers, and C. H. Tottle.
Canada Mortgage and Housing Corp., Ottawa, Canada K1A OP7. Mortgage and Housing Corporation and Environment Canada. Sewage Collectin and Treatment Report SCAT-1, April 1980. 90p, 6 Fig, 24 Tab, 14 Ref, 3 Append. NHA 5352 80/04.

Descriptors: *Impoundments, *Multiple-purpose reservoirs, *Storm water, *Urban drainage, *Recreatin, Aesthetics, Fishing, Boating, Operation and maintenance, Economics, Canada, Sediments, Coliforms, Pollutants, Nuisance algae, Plankton, Benthic fauna, Fish populations.

Storm water management by the use of impoundments (artificial lakes) was investigated in two urban developments in the Winnipeg, Manitoba, area. Impoundments are an attractive alternative to conventional storm sewers because they are economical, easy to maintain, and provide recreatin and aesthetic appeal. The Southdale area with eight interconnected impoundments and the Fort Richmond area with two interconnected impoundments were studied from 1975 to 1978. Influent and effluent storm water, plankton, fish, algae, and sediment samples were collected and analyzed to give an indicatin of the water quality and treatment efficiencies of the impoundments. The impoundment systems were found to remove a large amount of pollution loading from urban storm water runoff. Although the amount of fecal coliform bacteria was high in the sediments, the impoundments were found suitable for boating and fishing, but not for swimming. Most of the game fish (pike, perch, and suckers) were inpoor condition and there was an abundance of bullheads and fathead minnows (good for mosquito control). Algae control was a problem during the summer months. Benthic and fish surveys indicated a less than ideal level of water quality in both impoundment areas. A system of permanent wet bottom impoundments were deemed the most economical and attractive land drainage system for Winnipeg. (Sidney-IPA)
W80-05862

PROCESS FOR ELECTROLYZING WATER,
Billings Energy Corp., Provo. UT. (Assignee).
B. C. Campbell.
U.S. Patent No 4,177,118, 3 p, 8 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 244, December 4, 1979.

Descriptors: *Patents, *Water treatment, *Electrolysis, Separation techniques, Hydrogen, Oxygen, Equipment, Anodes, Cathodes, Lead dioxide.

Electrolysis of water is achieved by positioning at least one lead dioxide anode and at least one cathode in spaced relationship to each other. An electrically conducting medium is provided in contact with the anodes and cathodes to provide a conduction path through the conducting medium. The surfaces of the anodes and cathodes are wetted

with water, and an electric current is then passed through the conducting medium from the anodes to adjacent cathodes thereby generating hydrogen gas at the cathodes and oxygen at the anodes. The primary objective is to develop a process for the electrolysis of water where the anode comprises an inexpensive material in comparison to previous processes. (Sinha-OEIS)
W80-05965

5G. Water Quality Control

MATHEMATICAL MODELS FOR THE ANALYSIS OF MANAGEMENT OF NON-POINT SOURCES OF NITROGEN POLLUTION,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 6A.
W80-05796

WATER RESOURCES FOR CHICAGO--HISTORY AND FUTURE,
Metropolitan Sanitary District of Greater Chicago, IL.
For primary bibliographic entry see Field 5D.
W80-05822

IMPLEMENTING SECTION 208: WHAT DOES IT TAKE - A REPORT ON GROWTH MANAGEMENT AND WATER QUALITY PLANNING,
For primary bibliographic entry see Field 6E.
W80-05889

BEACH USE AND WATER QUALITY IN NEW YORK CITY,
Hunter Coll., New York. Dept of Geology and Geography.
C. Heatwole, and N. West.
New York Sea Grant Report Series No NYSG-RS-80-02, February 1980. 24 p, 2 Fig, 4 Tab, 3 Ref.

Descriptors: *Water quality, *New York, *Beaches, Swimming, Land use, Waste treatment, Water pollution control, Recreation facilities, Waste treatment, New York City(NY), Sea Grant Program.

New York City's 16.9 miles of public beach are heavily used now and will attract even more users in the years ahead. Crowding occurs despite safe, but generally unsatisfactory water quality. The major goal of Project 208 (Waste Treatment Management Plan) is to eliminate the sources of pollution and open new beach areas. This paper focuses on the implication Project 208 might have for swimming and beach use in the New York City area. Specifically it addresses the following questions: What is the current condition of city beaches and how are they used. How does water quality affect beach conditions and use. How will improving local water quality effect beaches and beach use. What changes should beach managers prepare for after estuarine conditions improve. (NOAA)
W80-05925

METHOD FOR REMOVING A WEAK ACID FROM AN AQUEOUS SOLUTION,
Akzona, Inc., Asheville, NC. (Assignee).
R. Smakman.
U.S. Patent No 4,177,140, 7 p, 3 Tab, 6 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 251, December 4, 1979.

Descriptors: *Patents, *Water quality control, *Water treatment, Demineralization, Industrial water, Anion exchange.

The invention offers several important advantages in the water demineralization for the preparation of boiler feed water, process water, or the like. The method comprises contacting the aqueous solution with an anion exchanger containing both strongly basic and weakly basic groups. The exchanger has a matrix comprising a copolymer of styrene and not more than about 20%, by weight, of a cross-linking agent, from about 3% to about 90% of the total basic groups being strongly basic groups of the quaternary ammonium type having the structure --CH2N+R1R2R3, wherein R1, R2, and R3 are independently selected from the groups consisting of --CH3, --C2H5, and --C2H40H, and the balance of the basic groups being weaking basic groups of the tertiary amine type. (Sinha - OEIS)
W80-05968

ELIMINATION OF STRAINER FOULING IN RECIRCULATING COOLING WATER SYSTEMS,
Nalco Chemical Co., Oak Brook, IL. (Assignee).
R. E. Myers.
U.S. Patent No 4,177,143, 4 p, 1 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 989, No 1, p 251-252, December 4, 1979.

Descriptors: *Patents, *Water quality control, Industrial water, Cooling water, Filtration, Biocontrol, Microorganisms, Filters, Backwash.

A method of improving the operation of filters of the type used to filter cooling water is used intermittently in direct heat exchange relationship to cool large office buildings and similar structures. The method comprises contacting the filters when not in use, with an aqueous solution which contains a preservative amount of an industrial biocide. Also shown is a method of controlling microorganisms in the filters by using a biocide with the backwash water. (Sinha - OEIS)
W80-05969

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

SATELLITES AS AID TO WATER RESOURCE MANAGERS,
National Environmental Satellite Service, Washington, DC.
For primary bibliographic entry see Field 7B.
W80-05731

PADDLE GENERATED WAVES IN LABORATORY CHANNELS,
Scripps Institution of Oceanography, La Jolla, CA. Shore Processes Lab.
For primary bibliographic entry see Field 2L.
W80-05776

WATER-MANAGEMENT PLANNING FOR ILLINOIS COMMUNITIES,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
A. Weeks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-201981, Price codes: A05 in paper copy, A01 in microfiche. UILU-WRC-79-0009, WRC Special Report No 9, 1979. 91 p, 1 Fig, 7 Tab, 59 Ref. NSF-OSS-77-21209.

Descriptors: *Water management(Applied), *Illinois, *Planning, *Decision making, *Institutions, Administrative agencies, Financing, Cities, Rural areas, Water supply, Water districts, Water resources, Education, Economics, Land use, Soil erosion, Operation and maintenance, Water works, Water treatment, Reservoir sitting, Water wells, Water costs, Water conservation, Water rates, Social aspects, Community education, Public participation, Water systems.

This report is a compilation of the reading materials used in a series of community water-education programs held in 1978. It was written for people who do not have training in water management but who want to understand the issues. The topics include: water conservation, water availability, water quality, management of water systems, economic concerns and financing of water systems, private home water systems, area-wide water districts, soil erosion and sedimentation, and the role of water in economic growth. A glossary is included.
W80-05791

MATHEMATICAL MODELS FOR THE ANALYSIS OF MANAGEMENT OF NON-POINT SOURCES OF NITROGEN POLLUTION,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
C. A. Shoemaker, S. Pacenka, and K. S. Porter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-201999, Price codes: A03 in paper copy, A01 in microfiche. Center for Environmental Research, Cornell Univ. Technical Completion Report, May 1980. 29 p, 10 Fig, 5 Tab, and 10 Ref. OWRT A-080-NY(1), 14-34-0001-8034.

Descriptors: *Nitrogen, *Pollutants, Regional analysis, *Wastewater treatment, Model studies, Simulation analysis, Optimum development plans, Optimization, Water pollution, Groundwater, Planning, Sewerage, Water pollution control, Water wells, Non-point source pollution, Sewerage network planning.

Simulation and optimization models have been developed to evaluate alternative procedures for controlling nitrate pollution of groundwater in eastern Suffolk County, N.Y. The management alternatives considered are restrictions on land development and augmented sewerage. The optimization model has been developed to determine the most economical location of wastewater treatment plants and pipe routes. The simulation model can be used to estimate changes in nitrogen loading that are liekly to occur as a result of future changes in land use. To assess the validity of the simulation models, the concentrations predicted by the moel were compared to the median observations in shallow wells in the Riverhead area. Except for several wells with unusual records of nitrate concentrations, the agreement between model predictions and observed concentrations was reasonably good.
W80-05796

FUTURE WATER QUALITY MONITORING PRIORITIES FOR THE TRUST TERRITORY OF THE PACIFIC ISLANDS,
Guam Univ., Agana. Water Resources Research Center.
P. A. Cowan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-204704, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 16, 1980. 61 p, 4 Fig, 8 Tab, 5 Ref, 2 Append. OWRT A-020-GUAM(1), 14-34-0001-0112.

Descriptors: *Water quality, *Islands, *Monitoring, Sea water, Potable water, *Planning, Water supply, *Mariana Islands, Water quality standards, *Trust Territory of the Pacific Islands, Micronesia.

Implementation of a comprehensive water quality monitoring program is not possible at the present time in the Trust Territory of the Pacific Islands (TTPI). Due to the remoteness of these islands, any routine monitoring must be accomplished by local district sanitation officers. Formulation of monitoring strategies must satisfy objectives which are realistically attainable based upon the constraints of manpower, time and finances. The highest priority monitoring strategy is the one which must be developed for the public water system (PWS). Total Coliform (TC), Free Residual Chlorine (FRC) and Turbidity analyses must be performed in order to insure the delivery of safe drinking water to the public served by these systems. It is imperative that FRC be checked daily; any violations of standards must be reported to the Environmental Protection Board (EPB) within 48 hours. The PWS data should be reported to the EPB once per month. A second monitoring scheme must evaluate the marine environments surrounding the various district centers. Fecal Coliform (FC), FRC and Turbidity should be monitored at representative sites at least twice per month. The marine water quality results should be reported to the EPB once per month.

W80-05803

SEASONAL WATER SUPPLY FORECASTING FOR AREAS HAVING SEASONAL SNOW-COVER,
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 2C.
W80-05808

WATER RESOURCES PLANNING USING COMPUTER GRAPHICS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
P. N. French, L. E. Johnson, D. P. Loucks, and D. P. Greenberg.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 106, No WR1, Proceedings Paper 15235, p 21-42, March 1980. 29 Fig, 4 Ref, 1 Append.

Descriptors: *Computers, *Computer models, *Water resources, *Planning, Water supply, Reservoirs, Rivers, Floods, Water quality, Optimization, Simulation analysis, Equipment, Analytical techniques, Computer graphics.

The application of interactive computer graphics to water resources planning provides convenience and flexibility on a minicomputer budget. Utilizing an interactive computer graphics system, a software package has been developed which provides the user with a variety of water resources planning models. Simulation models are applied to problems involving water quality prediction, flood control, and multireservoir operation. An optimization model performs a multiobjective analysis of costs and yields for water supply reservors. The computer graphcs framework permits three-dimensional data to be quickly and conveniently defined. Its flexibility in the types of available visual displays aids users in better understanding the possible impacts of water resources projects. As computer technology improves, interactive computer graphics hardware will provide the capability of analyzing and evaluating larger, more complex water resources problem. (Sims-ISWS)
W80-05827

DIMENSIONLESS GRAPHS OF FLOODS FROM RUPTURED DAMS,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2E.
W80-05829

GUIDELINES FOR CALCULATING AND ROUTING A DAM-BREAK FLOOD,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2E.
W80-05830

A PLAN FOR STUDY OF FLOOD HYDROLOGY OF FOOTHILL STREAMS IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W80-05876

INTERGOVERNMENTAL TENSION IN COASTAL ZONE MANAGEMENT: SOME OBSERVATIONS,
California Univ., Irvine.
For primary bibliographic entry see Field 6E.
W80-05904

FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION--HEC-1 CAPABILITY.
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 4A.
W80-05926

IRRIGATION PROJECT MONITORING: A FEEDBACK FOR PLANNERS AND MANAGEMENT,
Southampton Univ., (England).
J. R. Rydzewski.
The Civil Engineer in South Africa, Vol 20, No 12, p 309-312. December 1978, 7 Ref.

Descriptors: *Irrigation programs, *Monitoring, *Data collections, *Evaluation, *Project planning, Cost analysis, Forecasting, Soil moisture, Project post-evaluation, Administration, Benefits, Costs, Engineers estimates, Management, Multiple-purpoe projects, Optimum development plans.

Justifications for irrigation project monitoring, at all stages, are discussed along with the interrelationships of the many factors that must be considered in irrigation planning and management. Irrigation projects, which often represent a multi-million dollar capital investment, have no well established procedures for comparable systems of information flow to aid those involved in decision-making. Project monitoring is needed to fill this lack of information. Project monitoring should begin in the earliest stages of an irrigation project, which usually dates several years before actual irrigation of a crop begins. The engineering works for an irrigation system have to be completed approximately two years before actual crop production. Project monitoring must consider the whole package from the initial decisions to investigate the need for irrigation through the later stages of project operation and maintenance. Monitoring should also consider project formulation and objectives which can be many. The project planner/designer must incorporate these many objectives into a proposal through multi-objective planning. The main 'events' in an irrigation project are: (1) initial capital cost, (2) periodic replacement cost of large equipment, (3) operation and maintenance costs, (4) gross benefits resulting from the project output, and (5) the 'on-farm' production costs to achieve those gross benefits. Monitoring should provide feedback of information on a routine basis for all of these 'events'. If complete continuous monitoring is not possible the next best alternative is periodic ex-post evaluations. (Seigler-IPA)
W80-05985

6B. Evaluation Process

PLANS FOR WATER DATA ACQUISITION BY FEDERAL AGENCIES THROUGH FISCAL YEAR 1981.
Geological Survey, Reston, VA. Water Resources Div.
Geological Survey Office of Water Data Coordination report, October 1979. 94 p.

Descriptors: *Data collections, *Programs, *Federal Government, *Water resources development, Water supply, Water quality, Water utilization, Water pollution control, Land use, Urbanization, Flood control, Available water, Surface waters, Groundwater, Department of Agriculture, Department of Commerce, Department of Defense, Department of Energy, Department of Housing and Urban Development, Department of Interior, Department of Transportation, Council on Environmental Quality, Environmental Protection Agency, International Boundary and Water Commission, Nuclear Regulatory Commission, Tennessee Valley Authority, Water Resources Council.

This report was prepared by the Office of Water Data Coordination (OWDC), U.S. Geological Survey, in partial response to requirements of Office of Management and Budget (OMB) Circular A-67 (appendix A), which sets forth guidelines for the coordination of certain water-data acquisition activities by Federal agencies. Included are statements on Federal agencies' current water-data programs, plans and needs for water data through fiscal year (FY) 1981, and longer range water-data needs. The agency program summaries generally indicate that for FY 1981 most Federal programs for water-data collection will remain at approximately the same level of funding as for FY 1980. Water-quality data continues to be a major need of most agencies, particularly as it relates to nonpoint pollution sources. Several agencies expressed a need for more timely data and plan to expand their data networks to accommodate satellite relay and other real-time systems. The Nuclear Regulatory Commission and the Department of Energy have a need for additional data to evaluate the affects of radionuclides and nuclear-waste management on water resources. The Council on Environmental Quality requested that a greater effort be made to maintain continuity of the data over time. (Kosco-USGS)
W80-05716

COMMENSURATION IN FEDERAL WATER RESOURCES PLANNING: PROBLEM ANALYSIS AND RESEARCH APPRAISAL,
LTW Associates, Boulder, CO.
W. B. Lord, D. H. Deane, and M. Waterstone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-191026, Price codes: A06 in paper copy, A01 in microfiche. Research Report 79-2, prepared for Bureau of Reclamation, April 6, 1979. 124 p, 4 Fig, 34 Ref.

Descriptors: *Evaluation, *Social values, *Methodology, *Project planning, Formulation, Cost-benefit analysis, Decision making, Optimum development plans, Social participation, Economic justification, Planning, Water resources, Commensuration.

As an aid for Federal water resource planning, various existing approaches to commensuration, the process of measuring different things by a single standard or measure, are inventoried, and the usefulness of these approaches within the framework of the Water Resources Council's Principles and Standards is assessed. According to the Principles and Standards, commensuration must be performed for factors in the Social Well-Being Account, the Regional Development Account, the National Economic Development Account, and the Environmental Quality Account. Within a decision-making context, a standard of value or desirability is the only standard appropriate for commensurating diverse outcomes. Also, societal, rather than individual value must be used. Commensuration involves: (1) identification of the factors to be commensurated, (2) identification of whose value judgements are to be used, (3) identification of those judgements, and (4) the combination of individual judgements into a collective set. None of the commensuration techniques inventoried performed all four of the above factors; therefore, a combination of techniques may be needed. Data sources used in commensuration techniques may be either ex post, the use of past results, or ex ante, the use of hypothetical results. Further approach investigation is recommended in the areas of normative validity, empirical convergent validity, and potential modifications. (Seigler-IPA)
W80-05754

CULTURAL RESOURCES INVENTORY OF THE WEST DIVIDE PROJECT IN GARFIELD AND MESA COUNTIES, COLORADO,
Colorado State Univ., Fort Collins. Lab. of Public Archaeology.
H. LaPoint.
Final Report prepared for Bureau of Reclamation for the period March 1978-May 1978, May 1979. 287 p, 40 Fig, 18 Tab, 81 Ref, 3 Append. 7-07-40-S0405.

Descriptors: *Colorado, *Archaeology, *Dating, *Landuse, Colorado River, Surveys, Evaluation, History, Geologic time, Irrigation programs, Canal construction, Engineering, Value.

An intensive Phase III archaeological inventory in the 15,500 acres of the West Divide Project near Rifle, Colorado, identified 34 prehistoric sites and 11 historic sites. The West Divide Project will provide water for irrigation and municipal use. The entire project area is south of the Colorado River and is bordered to the west by Monument Creek, to the east by Divide Creek, and extends to the edge of the Colorado River to the north. Proposed for the area are three reservoirs and four canals. The average plow zone in the area of 12 to 18 in has had an adverse effect on the prehistoric cultural material remains in the area. Five events are seen as major in the history of the area: (1) the removal of the Ute Indians, (2) the arrival of the

railroad, (3) the Panic of 1893-94, (4) the modification of Federal land policies in 1909 and 1912, and (5) the advent of World War I. A prehistoric literature search was conducted prior to fieldwork. The actual field survey was conducted on foot and concentrated on areas not disturbed by agriculture. Walk intervals varying from 3 to 40 m were used. All sites were recorded on standard Colorado Site Inventory Record Forms. Materials at the prehistoric sites date their occupations from the Archaic Period to the Protohistoric Period. The historic sites are remains of Euro-American homesteads or squatter's dwellings. Three of the prehistoric sites are deemed eligible for nomination to the National Register of Historic Places. Only one historic site is eligible for nomination. (Seigler-IPA)
W80-05760

WATER-MANAGEMENT PLANNING FOR ILLINOIS COMMUNITIES,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
For primary bibliographic entry see Field 6A.
W80-05791

LIBBY DAM PROJECT: EX-POST FACTO ANALYSIS OF SELECTED ENVIRONMENTAL IMPACTS, MITIGATION COMMITMENTS, RECREATION USAGE AND HYDROELECTRIC POWER PRODUCTION,
Montana Univ., Missoula. School of Forestry.
For primary bibliographic entry see Field 6G.
W80-05794

NEW YORK-NEW ENGLAND RECREATION DEMAND STUDY, VOLUME I: EXECUTIVE SUMMARY HIGHLIGHTS OF THE NORTHEAST RECREATION METHODOLOGY PROJECT,
Abt Associates, Inc., Cambridge, MA.
V. A. Scardino, J. Schwalbe, M. Beauregard, C. Bottom, and P.G. Oostenbrug.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-200306, Price codes: A04 in paper copy, A01 in microfiche. Publication No. 11720-66-136-1-80-CR, Prepared for the Commonwealth of Massachusetts, Department of Environmental Management, 1980. 69p, 6 Fig, 6 Tab. OWRT C-7207(No. 6228)(1), 14-34-0001-6228.

Descriptors: *Recreation, *Recreatin demand, *Social participation, *Northest U.S., Model studies, Water sports, Winter sports, Ice skating, Swimming, Reasonable use, Connecticut, Maine, Massachusetts, New York, New Hampshire, Rhode Island, Vermont.

A computer forecasting methodology was developed for outdoor recreational activities in the seven states in the northeastern part of the United States (Connecticut, Maine, Massachusetts, New York, New Hampshire, Rhode Island, and Vermont). The model is designed to be used by planners to assess the potential effect of different supply configurations in the region and to anticipate future participation in outdoor recreational activities. To collect data, two waves of telephone interviews of individuals 12 years of age and older were conducted. The first wave, in September 1977, used a multi-stage stratified sampling pattern to gather responses for 16 specific activities such as sightseeing, swimming in salt water, swimming in fresh water, and canoeing. Responents were asked whether or not they had participated in an activity that summer and whether that participation involved a day trip or an overnight trip. In March 1978, a similar telephone survey was conducted with emphasis on fall/winter recreational activities such as fall foliage viewing, nature walks, ice skating, and sledding. The summer activity survey involved 1541 respondents and the winter survey involved 1539 respondents. During the summer, 58% participated in sightseeing, 49% swimming, and 46% visited fairs, zoos, and amusement parks. In the winter 43% viewed fall foliage, 37% took nature walks, and 33% bowled, an indoor sport. From the data on summer activities with either day or overnight trip involvement. Model results show that different dynamics and demographic characteristics influence participation in most activities. (See also W80-05805) (Seigler-IPA)
W80-05804

NEW YORK-NEW ENGLAND RECREATION DEMAND STUDY, VOLUME II: ANALYSIS AND COMPUTER MODELING OF SUMMER OUTDOOR RECREATION ACTIVITIES IN THE NORTHEAST,
Abt Associates, Inc., Cambridge, MA.
V. A. Scardino, J. Schwalbe, M. Beauregard, C. Bottom, and P. G. Oostenbrug.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-200314, Price codes: A15 in paper copy, A01 in microfiche. Publication No. 11719-343-51-1-80-CR, Prepared for the Commonwealth of Massachusetts, Department of Environmental Management, 1980. 333p, 45 Fig, 23 Tab, 3 Append. OWRT C-7207(No. 6228)(1), 14-34-0001-6228.

Descriptors: *Recreation, *Recreation demand, *Social participation, *Northeast U.S., Model studies, Water sports, Winter sports, Ice skating, Swimming, Reasonable use, Connecticut, Maine, Massachusetts, New York, New Hampshire, Rhode Island, Vermont.

A computer forecasting methodology was developed for outdoor summer recreational activities in the seven states in the northeastern part of the United States (Connecticut, Maine, Massachusetts, New York, New Hampshire, Rhode Island, and Vermont). the model is designed to be used by planners to assess the potential effect of different supply configurations in the region and to anticipate future participation in outdoor recreatinal activities. Data were collected by telephone interviews using a regional probability sampling pattern. Interviews were conducted for both summer and winter participation, however, only the results of the summer interviews were used for the development of the model. Results of the summer outdoor recreational activities show that 58% of the respondents participated in sightseeing, 49% swam in outdoor pools, and 46% visited zoos, fairs, and amusement parks. In winter the leaders were fall foliage viewing (43%), nature walks (37%), and bowling (33%). The forecasting model has 79 equations for 16 summer activities. The model is partitioned into the estimation of partipation on day trips versus overnight trips; the probability of participation, frequency of participation, and the probability of distance traveled. Model results show that well-defined summer activities such as swimming, tennis, and sailing are more readily modeled than loosely defined activities. Also, there is a strong indication that supply has an influence on the participation in certain outdoor recreational activities. (See also W80-05804) (Seigler-IPA)
W80-05805

GUIDELINES: THE USE OF CULTURAL RESOURCE INFORMATION IN WATER RESOURCE ENVIRONMENTAL IMPACT REPORTS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
D. A. Altshul.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202005, Price codes: A07 in paper copy, A01 in microfiche. MS thesis, 1980. 144p, 3 Tab, 30 Ref, 6 Append. OWRT A-088-ARIZ(1).

Descriptors: *Environmental effects, *Archaeology, *Federal project policy, Land use, History, Planning, Comprehensive planning, Decision making, Estimated benefits, Project planning, Coordination, Forecasting, Investigations, Water resources development, *Environmental study guidelines.

Techniques and guidelines for use by public officials when conducting cultural resource analysis on federally funded water projects were developed. The more important Acts and Executive Orders which deal directly with cultural resources and environmental impact analysis are summarized. The guidelines developed are divided into seven steps: (1) contact with the State Historic Preservation Office; (2) contact with state historical societies, museums, universities, and other recognized institutions, (3) contact with a qualified agency or consulting firm, (4) preparation of a list of prehistoric and historic sites and finds in the area, (5) incorporation of a report from the consultants into the initial environmental assessment, (6) modify plans incorporating the assessment into the cultural resource section of the final environmental report, and (7) assess the need for the recovery of significant data. Cultural resource management techniques and the guidelines should be incorporated into the earliest stages of project planning for large scale projects. Use of the guidelines for both large and small scale projects is discussed and illustrated using hypothetical case-studies. Three case-studies are given: (1) Buckhorn-Mesa Watershed Plan and Environmental Impact Statement, (2) Lower Queen Creek Watershed Plan and Environmental Impact Statement, and (3) a plan for a Demonstration Recharge Project in the Salt River Valley. Use of definite procedural guidelines will provide a measure of standardization and consistency in environmental reports. (Seigler-IPA)
W80-05807

EVALUATING THE IMPACT OF COASTAL ZONE ACTIVITIES: AN ILLUSTRATION OF THE EVALUATION RESEARCH APPROACH,
For primary bibliographic entry see Field 6E.
W80-05896

MARINE POLICY EVOLUTION: A REFERENCE GUIDE FOR COASTAL MANAGERS,
Natural Area Center, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-05898

INTERGOVERNMENTAL TENSION IN COASTAL ZONE MANAGEMENT: SOME OBSERVATIONS,
California Univ., Irvine.
For primary bibliographic entry see Field 6E.
W80-05904

FLOOD CONTROL SYSTEM COMPONENT OPTIMIZATION--HEC-1 CAPABILITY.
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 4A.
W80-05926

6D. Water Demand

FEDERAL NON-RESERVED WATER RIGHTS,
For primary bibliographic entry see Field 6E.
W80-05908

WATER FOR NON-INDIANS ON THE RESERVATION: CHECKERBOARD OWNERSHIP AND CHECKERBOARD JURISDICTION,
Gonzaga Univ., Spokane, WA. School of Law.
For primary bibliographic entry see Field 6E.
W80-05909

UNITED STATES V. NEW MEXICO AND THE COURSE OF FEDERAL RESERVED WATER RIGHTS,
For primary bibliographic entry see Field 6E.
W80-05915

APPLICATION OF THE HEC-5 HYDROPOWER ROUTINES,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 4A.
W80-05927

6E. Water Law and Institutions

RIVERS OF RESOURCE,
S. Lucas.
Water, No 32, p 13-15, May 1980. 4 Fig.

Descriptors: *Bristol Avon(UK), *Water rights, *Rivers, Watersheds(Basins), River flow, Banks, Drainage systems, Flood plains, Riparian rights, Competing uses, Irrigation, Land use, Regulation, Water utilization, Fishing, Recreation.

The Bristol Avon, a 115 kilometer river that discharges into the Severn estuary at Avonmouth, is a major resource for industry, home, agriculture, water supply, waste disposal, and navigation. The river has a roughly circular catchment area of 2,217 sq km with approximately a 50 km diameter. Land use along the river is about 80% agricultural, 13% urban, and 5% woodland. Many mill weirs are still in place on the river dating from its involvement in the wood trade. Mile Hillyer, Divisional Resource Planner at Wessex, divides the rivers' uses into five categories: (1) abstractions, (2) discharge, (3) navigation, (4) recreation, and (5) land drainage. Licenses for abstraction must be granted by the water authority who has to decide whether or not there will be an adverse effect on existing users. The largest abstractions are for industrial cooling. Discharges are controlled by a system of consents with the main group of dischargers being public sewage treatment works. Pollution is a major problem; however, much progress has been made in recent years. Control over navigation above the highest tide point is held by the British Waterways Board. The board is responsible for dredging, bank repairs, locks, and the sales of licenses to boat owners. Fishing and other forms of recreation are major pastimes on the river. Because the river channel is only big enough to carry a moderate size flood, a flood protection scheme is needed. The water authority acts to give users a clean, well-stocked, flood-free river. (Seigler-IPA)
W80-05757

WATER-MANAGEMENT PLANNING FOR ILLINOIS COMMUNITIES,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
For primary bibliographic entry see Field 6A.
W80-05791

ELECTRIC POWER AND THE FUTURE OF THE PACIFIC NORTHWEST,
State of Washington Water Research Center, Pullman.
K. N. Lee, D. L. Klemka, and M. E. Marts.
Report No 38, March 1980. 337p, 23 Fig, 14 Tab, 222 Ref. University of Washington Press, Seattle. OWRT A-087-WASH(1).

Descriptors: *Pacific Northwest U.S., *Hydroelectric power, *Columbia River, Hydroelectric plants, Politial aspects, Thermal power, Electric power, Turbins, History, Electric power production, Electric power costs, Electric power demand, Nuclear power plants, Utilities.

The history of electric power in the Pacific Northwest is reviewed along with a discussion of the complex intertwining of technology, economics, institutional arrangements, and the political choices of the future. Electric energy and its economics in the Pacific Northwest have been dominated by hydropower. Approximately 80% of the areas power comes from falling water. Over 40% of the nation's hydro potential is in the Columbia River and its tributaries. This vast resource produces abundant low cost power. The institutional and policy evolution of this hydro system has been shaped primarily by shifts in national politics and policies. Once the harnessing of economicaly realizable Columbia River hydropower was accomplished, attention turned with urgency, to hydrothermal power. Following 40 years of growth and frequent conflict, the 1970s brought a concern for what was being destroyed by the growth. environmental quality and mounting economic costs became topics of concern. With this, the regional power program began to falter and the government became increasingly involved. Alternative sources of energy must now be considered such as coal, nuclear, conservation, and renewable and unconventional sources. It is forecast that an additional 26,000 megawatts of generating capacity will be added in the area by 1998, mostly from thermal generation. Decisions made during the next several years will shape the future of the region for a generation. (Seigler-IPA)
W80-05810

WATER DISTRICTS CONTRACTING FOR WATER WITH THE BUREAU OF RECLAMATION - CAN A STATE-CREATED ENTITY VIOLATE STATE LAWS,
J. I. Thompson, and D. J. Wickham.
University of Davis, California, Law Review, Vol 11, No 2, p 473-490, November 1978.

Descriptors: *California, *Water districts, *Water contracts, State jurisdiction, Reclamation, Adoption of practices, Judicial decisions, Contracts, Legislation.

The State of California can control the ability of water districts to enter into contracts with the Bureau of Reclamation, Despite current federal and state law. The state could bring suit to void a water district's contract on the theory that a district acted ultra vives in entering into a contract which violates state law. If a contract violates the state constitution, it should be considered as ultra vives and void. Several reasons why the ultra vives doctrine should be applied are advanced. Several methods to ensure the doctrine's effective application are suggested. It is feasible to apply the doctrine to contracts between the Bureau of Reclamation and water districts despite the difficulties that exist because the action may require the joinder of the United States as a party. The United States can be joined as a party because section 8 of the 1902 Reclamation Act operates as a waiver to sovereign immunity. California should be able to assert control over the terms and conditions under which a water district can contract for water from federal water projects. (Daniels-Florida)
W80-05886

ONSHORE IMPACT IN FLORIDA OF OFFSHORE ENERGY DEVELOPMENT,
Florida Univ., Gainesville.
R. D. Woodson, J. Corbett, and M. Tannen.
University of Florida Law Review, Vol 31, No 2, p 284-320, Winter 1979.

Descriptors: *Florida, *Local governments, *Jurisdiction, Oil spills, Offshore platforms, Resources developments, Land use, Land management, Energy, Environmental effects, Environmental control, Water pollution control.

The extent to which Florida's local governments can encourage, discourage or regulate the onshore impact of offshore oil and gas development, deepwater ports and shipping, and offshore power plants, is discussed. Leasing of Outer Continental Shelf lands is outside local government control. Three vehicles exist for the expression of local government sentiment: (1) comments during preparation of an environmental Impact Statement; (2) comments prior to adoption of a leasing program; and (3) consistency provision of the Coastal Zone Management Act. Control over pipeline construction both on and offshore is limited. Local governments can encourage pipelin e development easier than they can discourage it. Local governments can control leasing decisions onshore through land use plans, land development regulations, the Developments of Regional Impact process, economic measures, pollution regulations, harbor and port controls, historic preservation districts, critical state conern designation and interlocal agreements. Few methods exist for local control over activities giving rise to oil spills and secondary developments. Local control is largely preempted by federal and state law. Local goverbnments can influence the onshore support facilities and offshore activities of plants under state jurisdiction. (Daniels-Florida)
W80-05887

FORD MOTOR COMPANY V. EPA: THE SIXTH CIRCUIT MUDDIES THE WATER IN THE REGULATION OF POLLUTION CONTROL METHODOLOGY,
W. B. deMaza, Jr.
University of Toledo Law Review, Vol 10, No 3, p 861-898, Spring 1979.

Descriptors: *Federal water pollution control act, *Permits, *Judicial decisions, *Administrative agencies, Regulation, Water pollution control, Federal government, Water Pollution sources, Legal aspects, Legislation, Water law, Industrial wastes.

In Ford Motor Company v. Environmental Protection Agency the United States court of Appeals for the Sixth Circuit ruled that a factory's state-issued water pollution discharge permit could not be vetoed by the Environmental Protection Agency pursuant to section 402(d) (2) (B) of the Federal Water Pollution Control Act, unless there was a specific prior statutory or regulatory prohibition regarding the objectionable terms of the permit. The court did not allow the agency to use explicit, relevant legislative history of the Act as grounds for denying the permit to Ford. Since the court insisted on prior published, specific regulations, the Agency's ability to enforce the FWPCA, when faced with new industry pollution methodology, is restricted. The Ford decision was directly responsible for amendments in the EPA regulations but it is too early to determine whether those changes solved the problems recognized by the Sixth Circuit. One interpretation of the Ford opinion demands that the Agency must foresee, and develop guidelines for, innovative pollution control methodology. (Wilson-Florida)
W80-05888

IMPLEMENTING SECTION 208: WHAT DOES IT TAKE - A REPORT ON GROWTH MANAGEMENT AND WATER QUALITY PLANNING,
R. A. Sales.
The Urban Lawyer, Vol 11, No 4, p 604-656, Fall 1979.

Descriptors: *Federal water pollution control act, *Water quallity control, *Land use, Legislation, Management, Water quality standards, Environmental control, Effluents, Federal government, Water pollution control planning.

In 1972 Congress enacted sweeping amendments to the Federal Water Pollution Control Act which radically altered and strengthened the nation's program for improving water quality. The 1972 amendments represent a milestone in effort to expand and coordinate both the cleanup and prevention of waste pollution. They recognize that a nontraditional, areawide approach to water quality control is needed. This approach for the most part is embodied in Section 208 of the Act. Section 208 calls for comprehensive, long-term Water Quality Management Plans to be drafted and put into effect by state and regional agencies. In addition to extensive planning for improved water quality, pollution problems are attacked through two interrelated strategies: (1) a statutory scheme for improving water quality through the adoption and enforcement of water quality standards and effluent limitation; and (2) a construction grant program offering massive federal grants for the construction and upgrading of wastewater treatment works. Section 208 acts as a federal land use control law, providing that areawide water quality plans must include a regulatory program for discharge facilities. (Wilson-Florida)
W80-05889

RESERVED WATER RIGHTS ON NATIONAL FORESTS AFTER UNITED STATES V. NEW MEXICO,
G. S. Young.
Utah Law Review, Vol 1979, No 3, p 609-628, 1979.

Descriptors: *Water rights, *National forests, *Unappropriated water, Judicial decisions, Legislation, Federal government, Prior appropriation, Legal aspects, Water utilization, Withdrawal.

In United States v. New Mexico, the Supreme Court limited Forest Service water use under the federal reseved water rights doctrine through a

narrow interpretation of the legislation setting up the forest system. Left unanswered was the most important and timely question concerning national forest water use: the effect of the Multiple-Use Sustained-Yield Act of 1960 (1960 Act) on the waters of previously and subsequently withdrawn forest land. The establishment of additional reserved water rights in unappropriated water on national forests is needed to fulfill the 1960 Act purposes of outdoor recreation, range, timber, watershed, and wildlife and fish uses. This argument is consistent with case language defining the reserve rights doctrine, and Forest Service history and interpretation of the 1960 Act, as well as congressional policies developed after the 1960 Act. Subsequent legislation mandating comprehensive forest management indicates that Congress intended to reserve additional water under the 1960 Act. In many circumstances, practical application and equities in water allocation also call for the result suggested. (Daniels-Florida)
W80-05890

FEDERAL WATER PROJECTS: AFTER CALIFORNIA V. UNITED STATES, WHAT RIGHTS DO THE STATE AND FEDERAL GOVERNMENTS HAVE IN THE WATER,
M. Neeley-Kvarme.
University of California, Davis, Law Review, Vol 11, No 2, p 401-439, November 1978.

Descriptors: *California, *Water rights, *Federal-state water rights conflicts, Judicial decisions, Eminent domain, Federal government, State government, Compensation, Navigation, Projects.

The United States Supreme Court's decision in California v. United States provides some delineation of the rights of the federal and state governments in federal water projects, but also raises some questions. The history of this litigation is examined. The problems associated with a system of voluntary compliance to state water law are analyzed. The full extent of federal and state powers in this area are explored. The federal government has authority to authorized projects under the navigation power. The extent of state and federal power in the latter's water projects are examined. The broad scope of federal navigatin power needs to be limited. The General Welfare Clause should govern federal water projects and the ramifications resulting from such projects. The states ability to protect their interests in water resources through terms and conditions of federal permits is an uncertain proposition. A state can secure local interests through appropriate recognition of property rights in water. By expanding the scope of state property rights, the state enlarges the uses of water which must be compensated when the federal government exercises eminent domain. (Daniels-Florida)
W80-05891

THE LEGAL ASPECTS OF APPROPRIATIVE WATER RIGHTS TRANSFER IN CALIFORNIA,
J. C. Bliss, and S. J. Imperati.
University of California, Davis, Law Review, Vol 11, No 2, p 441-472, 1978.

Descriptors: *California, *Water rights, *Water transfer, Legal aspects, Water users, Appropriation, Legislation, Judicial decisions, Irrigation efficiency, Irrigation, Water conservation, Water distribution(Applied).

California water rights law and agricultural use patterns impede the efficient use and conservation of state water resources. Water is wasted through widespread over-irrigation practiced by farmers. Due to the uncertain application of the Water Code's forfeiture provisions, efficient distribution of water, via sale or lease of water rights, is impeded. The best solution would be a statute authorizing and facilitating the transfer process. This would permanently remove the problems. The authorizing legislation should declare that reasonable and beneficial use by the transferee. It would also require a notice and hearing before a loss of an appropriative water rights through forfeiture. Such a statute would encourage the efficient use and concomitant conservation of the state's scare water resources. The inefficient water distribution caused by the current statutory scheme would be substantially solved by such legislation. (Daniels-Florida)
W80-05892

UPPER MISSISSIPPI RIVER BASIN COMMISSION: PUBLIC PARTICIPATION IN UPPER MISSISSIPPI SYSTEM MASTER PLAN (NEW RULE),
Water Resources Council, Washington, DC.
Federal Register, Vol 44, No 50, p 14537-14539, March 13, 1979.

Descriptors: *Water resources development, *Inland waterways, *Planning, Mississippi river basin, Mississippi river, Regulation. Decision-making, Administrative agencies, Legislation, Water policy.

Pursuant to Title I, the 1978 Inland Waterways Authorization Act, the upper Mississippi River Basin Commission promulgated guidelines for public participation in the development, revision, and implementatin of the Upper Mississippi River System Comprehensive Master Management Plan. As a general policy, public participation will ordinarily include informational output about the plan, public response and input, and discussins with the Commission. Participants include individuals and organizations. The Commission must develop a workable plan for public participation which satisfies minimum standards described in this New Rule. The continuing public participation program must contain mechanisms or activities for each objective listed. To improve information transfer and public awareness, two levels of information and education activities must be pursued. The first focuses on the general public; the second conerns public interests groups, agency representatives, and elected officials. There must be public meetings in areas most significantly affected, and public hearings in each state affected by the plan. (Daniels-Florida)
W80-05893

POLITICS IN THE UNITED STATES AND THE SALINITY PROBLEM OF THE COLORADO RIVER,
California Univ., Santa Barbara.
D. E. Mann.
Natural Resources Journal, Vol 15, No 1, p 113-128, January 1975.

Descriptors: *Water policy, *Salinity, *Colorado River, Unites States, International law, Colorado River basin, Colorado river compact, Administration, Water quality control, Regional economics, Decision-making.

Water policy-making in the United States is 'distributive' in character and has been carried out pursuant to traditional modes of political decision-making. A significant change in the context in which the traditional mode of political decision-making takes place has arisen out of international issues. However, when dealing with the salinity problem of the Colorado River, experience confirms the traditional mode of political behavior. The salinity control program will be largely a federal program carried out by the Bureau of Reclamation, largely financed by federal taxes and monitored by federal agencies. State and regional involvement is ensured by a strong local or regional coalition. This approach to the salinity problem promises extensive benefits to traditional beneficiaries with very little cost to the beneficiaries. Intraregional trade-offs of costs and benefits are ignored, leaving the general taxpayer to pay the bill. (Daniels-Florida)
W80-05894

CONTIGUOUS ZONES OF POLLUTION PREVENTION,
Ottawa Univ. (Ontario).
D. Pharand.
Syracuse Journal of International Law and Commerce, Vol 1, No 2, p 257-263, Fall 1973.

Descriptors: *Water pollution control, *Shore protection, *Jurisdiction, *Law of the sea, International waters, International law, International commissions, Coasts, Foreign countries, Environmental control, Oil pollution.

Recognizing a certain jurisdiction of the coastal state for pollution prevention presents conflicting problems. The dilemma is to attempt an equitable balance between the coastal state's right to protect its territorial and environmental integrity against the international community's right to exercise the basic freedoms of the seas. The validity of any national legislation as to other states is dependent on international law. The legal basis for a pollution prevention zone may be found in international law, from the standpoints of both convention and custom. With respect to convention law, there is not much enabling legislation, but there is nothing in the various conventions of a prohibiting nature. Three of the four Geneva conventions contain provisions which have positive relevance. A better basis for the validity of a contiguous zone for pollution prevention purposes can be found in customary law. Basic concepts such as self-defense and self-protection can be employed as a foundation for an international system of pollution prevention. (Wilson-Florida)
W80-05895

EVALUATING THE IMPACT OF COASTAL ZONE ACTIVITIES: AN ILLUSTRATION OF THE EVALUATION RESEARCH APPROACH,
R. E. Bowen, F. W. Hoole, and S. H. Anderson.
Coastal Zone Management Journal, Vol 7, No 1, p 25-46, 1980. 3 Fig.

Descriptors: *California, *Beaches, *Shore protection, *Recreation demand, Public access, Recreation, Programs, Social impact, Statistics, Water users, Evaluation, Coastal plains.

Rigorous analyses of the impact of coastal zone activities are felt to be problematical. The use of the cross-disciplinary evaluation research approach would minimize analysis difficulties. This research approach categorizes alternative explanations for impacts into four groups: (1) internal validity; (2) statistical conclusion validity; (3) external validity; and (4) construct validity. This approach is applied to a study of the 1972 California Coastal Zone Conservation Act (Act). The focus of the study is narrowed to one of the goals of the Act - increased public access and recreational opportunities in the coastal zone. Plausible rival explanations of the impact of this Act on particular goals are discussed. The study shows that there was a significant increase in beach use since the passage of the Act, and concludes that the Act has a significant impact on beach use. Evaluation research will bring an understanding of which coastal zone programs and policies actually work. (Tabano-Florida)
W80-05896

THE CLEAN WATER ACT'S SECTION 404 PERMIT PROGRAM ENTERS ITS ADOLESCENCE: AN INSTITUTIONAL AND PROGRAMMATIC PERSPECTIVE,
Lewis and Clark Coll., Portland, OR. Northwestern School of Law.
M. C. Blumm.
Ecology Law Quarterly, Vol 8, No 3, p409-472, 1980.

Descriptors: *Federal water pollution control act, *Permits, *Solid wastes, Administration, Administrative agencies, State governments, Regulation, Water pollution, Programs, Coordination.

Section 404 regulates the addition of solid materials into waterbodies. The scope of the 404 program and its statutory exemptions for minor impacts and federal projects, is explored, including an examination of the program's relationship to its antecedent, Section 10 of the Rivers and Harbors Act of 1899. The process of issuing 404 permits is described. Interagency relationships between the Corps of Engineers and the Environmental Protection Agency are necessary to the successful operation of the 404 as is discussed. The relationship between

the section 404 program and the Clean Water Act's National Pollution Discharge Elimination System (NPDES) is outlined and suggestions designed to maximize the effectiveness of both permit programs are made. The role of the states in the 404 program is explored. How coordination between the 404 program and state land and water use controls can be improved is discussed. Successful operation of the 404 program will require continued public scrutiny and greater cooperation among federal agencies and between the federal government and the states. (Daniels-Florida)
W80-05897

MARINE POLICY EVOLUTION: A REFERENCE GUIDE FOR COASTAL MANAGERS,
Natural Area Center, Washington, DC.
D. Laist, and J. Epting.
Coastal Zone Management Journal, Vol 7, No 1, p 71-84, 1980. 7 Ref., 1 Tab.

Descriptors: *Continental shelf, *Resources development, *Management, Resouces, Oil, Fisheries, International Law, International waters, Planning, State governments, State jurisdiction.

The public resources of the Outer Continental Shelf are experiencing a wave of federal resource allocation commitments. The resulting environmental and economic implications of this suggest the need for effective coastal management of marine resources. The article presents a table in which a timeline of selected events which have shaped coastal and marine policy are listed. It is felt that these events will indicate trends in future coastal and marine management efforts. One pattern discussed is a shift in policy focus from marine science and engineering to management concerns. Coastal and marine resources are viewed as increasingly important, particularly for oil extraction and fisheries. The influence of international actions and concerns on marine planning and management are also discussed. There is an expanding need for an increased state role in marine management. The conservation-oriented thrust of marine management is seen as giving way to a more development-oriented approach. A comprehensive mechanism must be set up for making the necessary compromises and trade-offs in a rational and responsive manner. (Tabono-Florida)
W80-05898

CALIFORNIA MEETS THE LNG TERMINAL,
California Coastal Commission, San Francisco.
W. R. Ahern.
Coastal Zone Management Journal, Vol 7, No 2-3-4, p 185-221, 1980. 10 Fig, 2 Tab.

Descriptors: *California, *Natural gas, *Safety, *Shore protection, Environmental effects, Legal aspects, Energy, Sites, Public utilities, Facilities, Regulation, Administrative agencies.

The proposal by California's gas utilities to build a liquefied natural gas (LNG) terminal on the coast has generated five years of controversy, stalemates among agencies, and new state legislation. No final decision is yet in sight. Different perceptions of the public safety risks from LNG have played a major role in this controversy. Agencies and other parties have generally become increasingly conservative in regulating these risks as the LNG issue has continued. How agencies viewed the seriousness of the risks depended on many factors: (1) how close they were to neighborhoods that might be affected; (2) whether they had LNG-related responsibilities; (3) their experience with LNG and other hazardous materials; and (4) the professional orientation of their staffs. There appears to be no substitute for well developed, comprehensive federal regulations and standards to provide a reasonable level of public safety. Other helpful measures include: (1) early site screening; (2) side payments for the assumption of involuntary risks; and (3) removing the decision-making process to higher levels of government. (Wilson-Florida).
W80-05899

PUBLIC INVOLVEMENT IN OFFSHORE OIL DEVELOPMENT: LESSONS FROM NEW ENGLAND,
Rhose Island Univ., Kingston. Coastal Resources Center.
D. D. Robadue, Jr., and V. K. Tippie.
Coastal Zone Management Journal, Vol 7, No 2-3-4, p 237-270, 1980. 1 Fig, 2 Tab.

Descriptors: *Oil industry, *Continental shelf, *Resources development, *New England, Public access, Offshore platforms, Leases, Environmental effects, Regulation, Coasts, Federal government, State governments.

More than sixteen years have elapsed since oil companies and the United States (U.S.) Geological Survey first took an interest in the potential for oil and gas under Georges Bank off the New England coast. In New England, the concern has not been whether offshore oil will occur but when and under what conditions. The overall guest has been for a larger public involvement in matters affecting the New England shore and adjacent waters. In addition, four substantive issues have emerged and received public attention: energy benefits, onshore impacts, environmental effects, and fishing industry conflicts. Massachusetts and Rhode Island have played prominent roles in influencing the federal lease-sole process. Despite numerous problems, New England has addressed a full range of environmental concerns regarding the utilization of a physiographic area beyond any state's legal jurisdiction and any single federal agency. Throughout this interactive process between the region and the federal government, even though divergent state positions have evolved, there is a growing regional acceptance of coastal zone management concepts. (Wilson-Florida).
W80-05900

OCS DEVELOPMEN: A NEW LAW AND A NEW BEGINNING,
House, Washington, DC.
J. M. Murphy, and M. H. Belsky.
Coastal Zone Management Journal, Vol 7, No 2-3-4-, p 297-337, 1980.

Descriptors: *Continental shelf, *Resources development, *Federal government, Regulation, Oil industry, Mineral industry, Legislation, Mining, Environmental effects, Natural gas.

On September 18, 1978, President Carter signed into law the 1978 Outer Continental Shelf Lands Act Amendments (OCSLAA). The 1978 OCSLAA addresses the promises and risks of mineral resources development on our Outer Continental Shelf (OC). Increasing attention has been focused on potential oil and gas resources off the shores of the world's continents and islands. In the early 1970's numerous Congressional committees responded to constituent inquiries and concerns and commenced an investigation of OCS activities. The Ad Hoc Select Committee on the OCS was created during the 94th Congress. Reconstituted at the beginning of the 95th Congress, the Committee introduced identical bills in the Senate and House, which were eventually passed as the 1978 OCS Amendments. Detailed in its purposes, policies, and findings, Congress sought to assure expeditious development of OCS resources, to promote better planning and information, increased competition, safer operations, and more state, local and citizen participation. (Wilson-Florida)
W80-05901

THE VALLEY WATER SUIT AND ITS IMPACT ON TEXAS WATER POLICY: SOME PRACTICAL ADVICE FOR THE FUTURE,
Smith, McIlheran, Lauderdale and Jones, Weslaco, TX.
G. F. Smith.
Texas Tech Law Review, Vol 8, No 3, p 577-636, Spring 1977.

Descriptors: *Texas, *Water rights, *Water users, Agriculture, Judicial decisions, Rio grande river, Water resources, Value, Common law, Regulation, Efficiencies.

This article examines the Texas Valley water litigation in which the courts attempted to determine the rights of agricultural and other users to the waters of the lower Rio Grande. Many of the principles derived from this litigation are applicable to other regions of Texas where the availability of water is or will become a problem. The article examines in great length the fourteen years of litigation that ultimately determined users' rights. The principles derived from this litigation are felt to be especially applicable to the High Plains of Texas today. The availability of water is the determinative factor in the value of this land, yet water rights are still ascertained under the English Common Law concept of absolute ownership. A carefully regulated use of the diminishing water supplies in the area is needed, and the courts rather than legislators should make the determinations. Even if the courts find absolute ownership to be a valid doctrine, they still must determine the limitations to be placed on such ownership to prevent the doctrine from continuing as an obstacle to a more sensible and efficient use of diminishing water resources. (Tabano-Florida).
W80-05903

INTERGOVERNMENTAL TENSION IN COASTAL ZONE MANAGEMENT: SOME OBSERVATIONS,
California Univ., Irvine.
J. B. Rosener.
Coastal Zone Management Journal, Vol 7, No 1, p 95-109, 1980.

Descriptors: *Shore protection, *Coasts, *Interagency cooperation, Federal government, Local governments, Administrative agencies, Management, Environmental control, State governments, Resource development, Regulation.

The Federal Coastal Zone Management Act of 1972 states that the management of coastal resources is a federal and state responsibility, yet in most states it is on the local level that land use control is exercised. Intergovernmental tension between state and local officials is bound to occur as states play a larger role in managing coastal resources. Successful coastal management will require intergovernmental cooperation and a minimum of state/local conflict. Coastal resources management involves both planning and regulation. It is the regulatory aspect of coastal programs that has created the most intergovernmental tension. Based on the observation of five coastal programs, it is suggested that research attention be focused on how local officials perceive state coastal zone management programs, how the exercise of administrative skill is related to those perceptions, how those perceptions contribute to the presence or absence of intergovernmental tensions, and how intergovernmental tension is related to the achievement of coastal zone management goals. (Wilson-Florida)
W80-05904

SETTLEMENT OF MARITIME BOUNDARY DISPUTES: AN ANALYSIS OF THE LAW OF THE SEA NEGOTIATIONS,
Tufts Univ., Medford, MA. Fletcher School of Law and Diplomacy.
P. C. Irwin.
Ocean Development and International Law Journal, Vol 8, No 2, p 105-148, 1980.

Descriptors: *Law of the sea, *Negotiations, *Boundary disputes, Conferences, International law, Boundaries(Surfaces), Treaties, Jurisdction, International commissions, United nations.

Maritime boundary delimitation will likely continue to be a source of disputes between states, even under the prospective Law of the Sea Convention. A compromise article in the Convention which covered such disputes would be effective only insofar as it permitted unilateral referral to a third party when bilateral methods fail. But the negotiation of any compromise clause has proven extremely difficult. One group of states refuses to accept any compulsory third-party system. The other group rejects any non-compulsory procedure. Compromise efforts have focused on gormulae which would exempt only some boundary disputes from compulsory settlement. An exception for disputes which predates the Convention has

drawn the most attention. Other compromise possibilities have assumed that all delimitation disputes would ultimately be subject to some sort of compulsory jurisdiction. Some would moderate the effects of the compulsion by using nonbinding third party procedures, and by inserting preliminary stages before the final delimitation. A compromise clause will have the greatest value if it makes all delimitations subject to some form of compulsory third party procedure. (Wilson-Florida).
W80-05905

CUSTOMARY INTERNATIONAL LAW AND DEEP SEABED MINING,
Syracuse Univ., NY. Coll. of Law.
L. F. E. Goldie.
Syracuse Journal of International Law and Commerce, Vol 6 No 2, p 173-182, Winter 1978-79.

Descriptors: *International law, *Beds under water, *Resources development, *Law of the sea, Mining, Manganses, United nations, History, International waters, Economics, International commissions, Resource allocation.

number of congressional documents have been produced over the last decade presenting projections of the expected future world demand for and supply of the minerals and materials to be found in the manganese nodules of the deep seabed. They predict either supply shortages of land-based minerals or possibly unstable political conditions in the countries that produce them. It is predicted that if the deep seabed mining of manganese nodules should come into commercial production, the effect would merely be one of stabilizing prices and preventing a sky-rocketing inflation which could threaten world stability. One of the traditional principles of international law of the sea has been the concept of the high seas as common property. The Third United Nations Conference on the Law of the Sea has developed the concept of the Economic Zone, which many states are putting into practice. A new dimension of law is emerging which would treat the seabed and ocean floor as the common heritage of mankind. (Wilson-Florida)
W80-05906

DOMESTIC LEGISLATION AND THE LAW OF THE SEA CONFERENCE,
Congress, Washington, DC.
P. N. MCCloskey, Jr.
Syracuse Journal of International Law and Commerce, Vol 6, No 2, p 225-232, Winter 1978-79.

Descriptors: *Law of the sea, *Mining, *Treaties, *Legislation, Beds under water, United States, International waters, Foreign countries, Negotiations, Oceans, International law, Regulation.

The broadening of trade relationships among nations may often be more helpful to world peace than diplomatic negotiations. This question squarely underlies an issue facing the United States Congress: whether Congress should unilaterally enact a law encouraging United States industry, in partnership with foreign corporations, to mine the seabed. Or, conversely, whether Congress should hold legislation pending the conclusion of the current negotiations. The benefits of a treaty cannot be understated: finalyzing of territorial seas at twelve miles; firm definitions of rights within a 200 mile economic zone; and establishment of a system of dispute settlement for conflicts. However, it seems inevitable that Congress will pass deep seabed mining legislation during this Congress. It is clear that other countries of the world will use such a bill as a model for similar legislation. The U.S. bill should include the following concepts: (1) preservation of the concept of freedom of the seas; (2) no assertion of sovereignty over the sea bed; (3) comprehensive environmental protection; (4) establishment of revenue sharing; and (5) precise definition of the terms, conditions and restrictions on licensing. (Wilson-Florida).
W80-05907

FEDERAL NON-RESERVED WATER RIGHTS,
D. D. Freudenthal.
Land and Water Law Review, Vol 15, No 1, p 67-98, 1980.

Descriptors: *Federal government, *Water rights, *Prior appropriation, Administrative agencies, Federal reservations, Legal aspects, Reservation doctrine, Water users, Water allocation(Policy), Water law, Federal jurisdiction.

On June 25, 1979, the Solicitor of the United States Department of Interior issued a formal opinion on federal water rights. The Opinion attempts to set forth a doctrinal basis for federal non-reserved right claims to water. While the primary focus of the Opinion is a restatement of the established doctrine of non-Indian reserved rights, most professional attention has been devoted to the assertion of a new and alternative basis for federal claims to water. The Solicitor defines the rights as water rights obtained through appropriation and use for congressionally authorized purposes. Western water lawyers and administrators have questioned the legal basis and the workability of the doctrine. An analysis of the historical and legal context of the Opinion, the Solicitors use of authorities, and practical dimensions leads to three conclusions: (1) the assertion of appropriation for congressional is a formal statement of opinion, not of established legal doctrine; (2) the reasoning on which the doctrine rests is flawed; and (3) if the courts were to accept the Solicitor's position, the operational and functional results would be disastrous. (Wilson-Florida)
W80-05908

WATER FOR NON-INDIANS ON THE RESERVATION: CHECKERBOARD OWNERSHIP AND CHECKERBOARD JURISDICTION,
Gonzaga Univ., Spokane, WA. School of Law.
P. W. Dufford.
Gonzaga Law Review, Vol 15, No 1, p 95-131, 1979.

Descriptors: *Indian reservations, *Water rights, *Federal-state water rights conflicts, Prior appropriation, Water law, Jurisdiction, Federal jurisdiction, Reservation doctrine, Water users, State governments, Water allocation(Policy).

The conflict between native Indians and the white majority in the United States is strikingly exemplified by the ongoing fight in the west over control of scarce water resources. As a legal matter, the controversy represents a failure to resolve conflicting ideas about federalism. One issue in this conflict, which has not received a great deal of attention, concerns the water rights of non-Indian landowners within Indian reservations. The United States has general plenary power over Indian affairs derived explicitly from the commerce clause. However, a fundamental legal proposition is that proprty ownership is governed by the states. Whether state law an reach through reservation boundaries to apply to the affairs of non-Indians is a difficult issue. State law can be subject to express congressional preemption. In the absence of express preemption, state law may not apply, if it conflicts with the federal law of Indian autonomy. The prior appropriation system is theoretically capable of adjusting conflicts so that no one's rights are infringed. (Wilson-Florida).
W80-05909

STATE BOUNDARY EXTENSIONS ON THE CONTINENTAL SHELF,
G. Yawman.
New York Sea Grant Law and Policy Journal, Vol II, p 1-43, 1978.

Descriptors: *Continental shelf, *Boundaries(Surfaces), *State jurisdiction, State governments, Oceans, Political aspects, Boundary disputes, Coasts, Resources development, Maps.

Recent technological advancements have caused a growing interest in the political division of the continental shelf. The emerging significance of economic zones, territorial seas, and other political zones has necessitated a critical examination of presently established boundaries and applicable boundary principles. One part of this examination is the clarification of established lines, and equally important are the extensions of existing boundaries. To coincide with new interests and technologies these lines must be drawn through previously undelimited seaward areas. A number of factors must be considered in establishing new lines. For the coastal states of the United States, the question of the location lateral and extended lateral boundaries - boundaries drawn between adjacent states from the coastline seaward - is an issue of increasing significance. These boundaries will be drawn under a variety of differing circumstances. Political, historical, and physiographic characteristics will all play some role in the delimitation of these lines. Extended lateral boundaries must be delimited with a primary goal in mind - an equitable division of continental shelf resources. (Wilson-Florida).
W80-05910

IRONDEQUOIT BAY DEVELOPMENT PLANNING: SOME IMPLICATIONS FOR INSTITUTIONAL REFORM,
J. Barber, and P. B. Webb.
New York Sea Grant Law and Policy Journal, Vol II, p 201-267, 1978.

Descriptors: *New York, *Land use, *Environmental control, *resources development, Regulation, Planning, Management, Recreation, Local governments, Shore protection, Legislation, State governments.

Irondequoit Bay lies off Lake Ontario in Monroe County, New York about five miles from the City of Rochester. In recent years, several municipalities bordering Irondequoit Bay have made attempts to protect the Bay's fragile areas and to develop the Bay for recreation. The principle instruments of control of land use at the local level are zoning and subdivision regulations. The New York Department of Environmental Conservation has jurisdiction over development of any navigable waters in the state. By 1977, the Planning Department and the Monroe County Environmental Management Council began development of a coordinated land use plan for Irondequoit Bay. The plan had two avowed purposes: (1) to protect the critical features of the bay to retain its beauty and attraction; and (2) to develop the bay as a recreational resource. The plan was adopted and implemented through land acquisition, watershed coordination and other devices. The Irondequoit Bay planning effort has important implications for the development of a coastal zone management for New York State, in conformity with Federal guidelines prescribed by the Coastal Zone Management Act. (Wilson-Florida)
W80-05911

BEACH ACCESS: AN HISTORICAL OVERVIEW,
K. Niven.
New York Sea Grant Law and Policy Journal, Vol II, p 161-199, 1978.

Descriptors: *Public access, *Beaches, *Recreation facilities, Public rights, Land use, Legislation, Legal aspects, Shore protection, Management, Public benefits, Recreation.

The demand for beach access for recreational purposes is often in direct conflict with the interests of private developers. Generally, private interests have prevailed in the past. The common law has responded in a limited manner to the public need use of the foreshore for recreation. Several doctrines have been used in the course of history, including: (1) public turst; (2) customary rights; and (3) implied dedication. The inherent limitations of the common law in ensuring beach access have led to recent statutory approaches. The most comprehensive bill introduced in Congress to date is the National Open Beaches Bill of 1973. The Bill is limited, however, because it does not create any new public rights beyond those protected by common law doctrine applied in the state courts. The Coastal Zone Management Act of 1972 may help alleviate problems of lack of shore line recreational areas. Regulatory techniques may assist in restraining private development of beach areas for

non-recreational uses, but do not by themselves ensure public access to the preserved shoreline. Federal, state or municipal acquisition of public user rights or easements would appear to be the most feasible solution. (Wilson-Florida)
W80-05912

THE ACQUISITION OF DEVELOPMENT RIGHTS IN THE COASTAL ZONE: AN ALTERNATIVE TO WETLANDS REGULATION,
D. M. Ascher.
New York Sea Grant Law and Policy Journal, Vol II, p 95-159, 1978.

Descriptors: *Development, *Wetlands, *Shore protection, Economic impact, Regulation, Coasts, Land use, Public rights, Environmental control, Legal aspects.

The preservation of coastal wetlands has become a high priority goal, witnessed by the Coastal Zone Management Act and the follow through by the states in developing coastal zone management programs. The many benefits from coastal wetlands are not guaranteed. Competing uses of coastal lands, especially those attending urbanization are a constant threat. State and local regulations to counter the threat to wetlands are commonplace, but encounter obstacles in the form of constitutional guarantees of property rights. The state legislatures and courts have gone a long way towards sanctioning the concept of detachability and negotiability of development rights for the purpose of effecting appropriate public-private partnerships in land development control. Recent experimentation with the transfer of development rights from parcel to parcel shows promise of achieving similar reservation of community use or values in wetlands at a lower cost. Generally the courts have confirmed the legality of the transfer of development rights technique, but have cautioned governments to deal fairly with the private developer. (Wilson-Florida)
W80-05913

AQUACULTURE: EMERGING ISSUES OF LAW AND POLICY,
G. Newton.
New York Sea Grant Law and Policy Journal, Vol II, p 45-94, 1978.

Descriptors: *Aquaculture, *Aquatic plants, *Resources development, *Aquatic productivity, Legal aspects, Food, Energy, Legislation, Aquatic animals, Aquatic algae, Technology, Research and development.

Aquaculture is the husbandry, through control over growth conditions, of aquatic plants and animals with population densities much greater than those which occur naturally. Its purpose has primarily been to produce aquatic food organisms, but recent concern over the energy crisis has sparked a secondary interest in aquaculture as a means of storing solar energy in algae. Although only one federal agricultural act refers specifically to aquaculture, it can be argued that aquaculture is a subset of agriculture. Agricultural statutes are unclear as to whether or not aquaculture is to be included. Aquaculture has numerous advantages over both fishing and farming. The components of a policy for the successful development of aquaculture include encouraging research and technology and also affording commercial aquaculturists property rights in public waters. Federal and state legislative activities promoting, regulating, researching and financing aquacultural enterprises have yielded meager, disappointing results. Some form of federal action will be required to give aquaculture needed parity with agriculture because of existing programs which have created preferences for agricultural development and operations. (Wilson-Florida).
W80-05914

UNITED STATES V. NEW MEXICO AND THE COURSE OF FEDERAL RESERVED WATER RIGHTS,
A. E. Boles, Jr., and C. M. Elliott.
University of Colorado Law Review, Vol 51, No 2, p 209-235, Winter 1980.

Descriptors: *Federal-state water rights conflicts, *Judicial decisions, *Reservation doctrine, *Water rights, Water users, Water law, State jurisdiction, Prior appropriation, Federal jurisdiction, Federal reservations, National forests, Streamflow.

During the past several years, western water users have reacted with alarm to an increasing federal presence in water policy and law. Nontheless, the United States Supreme Court recently strengthened the authority of the states over water in two recent, concurrent decisions. In United States v. New Mexico, the Supreme Court rebuffed expansive federal claims to water in the Gila National Forest in New Mexico. The government's minimun stream flow claims were rejected as inconsistent with a primary purpose of a national forest, namely, to enhance usable water quantities in the arid west. The Court's decision clarifies and resolves significant aspects of the reserved rights doctrine that have eluded legislative solutions. The basis for reserved rights lies in the purposes for which the land was reserved. Reserved water rights for uses which conflict with a primary purpose will not be recognized. Thus, users of water arising on or flowing through a national forest, whose priorities are later in time than the date of the reservation, need not fear injury from federal minimum stream flows. (Wilson-Florida)
W80-05915

LATIN AMERICAN UNILATERAL DECLARATIONS OF 200-MILE OFFSHORE EXCLUSIVE FISHERIES: TOWARD RESOLVING THE PROBLEMS OF ACCESS FACED BY THE U.S. TUNAFISH INDUSTRY,
Whittier Coll., CA. School of Law.
J. M. Fisher, S. Wood, and E. T. Burge.
Southwestern University Law Review, Vol 9, No 3, p 643-670, 1977. 5 Append.

Descriptors: *Jurisdiction, *International law, *Fisheries, Law of the sea, International waters, Foreign countries, Boundary disputes, Fishing, Negotiations, Economic impact, Oceans.

A growing number of coastal states, such as Ecuador, claim that the area within 200 miles offshore belongs exclusively to them. The 200 mile claims, if allowed to all coastal states, would result in municipal jurisdiction of up to thirty-five percent of the world's oceans. This extension of national sovereignty has had severe repercussions on the tuna industry in the eastern Pacific. This action has led to seizures of American tuna boats, fines, confiscated catches, exorbitant license fees. The unilater declarations of 200 mile offshore economic zones and the access insecurity of the United States fleet ultimately generate negative economic pressures throughout the larger tuna industry. Several alternative methods of coping with this problem have been presented. Legislation has been enacted to extend the territorial sea of the United States to 200 miles. However, analysis of this alternative reveals that it has the potential of making the problem worse. The best method appears to be a multilateral resolution reached through negotiation. The territorial sea must be defined by international agreement. (Wilson-Florida)
W80-05916

TEXAS UNDERGROUND WATER LAW: THE NEED FOR CONSERVATION AND PROTECTION OF A LIMITED RESOURCE,
G. D. Cisneros.
Texas Tech Law Review, Vol 11, No 3, p 637-653, Spring 1980.

Descriptors: *Texas, *Water conservation, *Groundwater availability, Underground, Water rights, Legal aspects, Water users, Legislation, regulation, Water shortage, Judicial decisions.

Serious underground water problems have developed in Texas. Because the development of additional surface water would require large public expenditures, the need for effective underground water conservation in Texas is imperative. Unfortunately, the Texas Supreme Court and legislature have created a legal environment that is incompatible with effective conservation. The legal system's failure can be attributed to two factors: (1) the Supreme Court has continued to apply the archaic English rule of absolute ownership of underground water; and (2) the legislature has delegated the power to regulate groundwater to those least likely to exercise it - the users of underground water. The 1949 Texas Goundwater District Act merely provides for regulation upon a permissive basis. The importance of underground water in Texas distates that the state adopt a system more conducive to conservation. Any proposal for change will not improve the current system unless two conditions are met: (1) the implementation of much needed conservation measures are assured, including production controls; and (2) individual groundwater users are given a greater degree of protection against unreasonable interference with their property rights. (Wilson-Florida)
W80-05917

THE PLIGHT OF AMERICAN CITIZENS INJURED BY TRANSBOUNDARY RIVER POLLUTION,
D. C. Arbitblit.
Ecology Law Quarterly, Vol 8, No 2, p 339-370, 1979.

Descriptors: *Water pollution, *Remedies, *Canada, *United states, Legal aspects, International law, Jurisdiction, Judicial decisions, State jurisdiction, Treaties, Water Law.

The legal remedies available to American citizens injured by transboundary pollution are analyzed. A direct action against Canadian polluters, either private or governmental, will fail because Canadian courts lack jurisdiction. Using state long-arm statutes to obtain jurisdiction over Canadian defendants will fail because Canadian law will not enforce judgments based on such jurisdiction. The Boundary Waters Treaty between the United States and Canada provides some relief for American citizens injured by Canadian water pollution. However, the treaty has no enforcement mechanism to settle transboundary pollution disputes. The only possibility for recovery arises from the 1976 Foreign Sovereign Immunities Act (FSIA). Foreign nations have a duty to prevent private parties from causing transboundary pollution. An FSIA suit would give American citizens the means to enforce this duty against the Canadian government. Jurisdictional problems inherent in direct or long-arm actions would be avoided. An FSIA suit would provide an effective and predictable resolution of Canadian-American transboundary disputes, by protecting American interests without unduly burdening Canadian expectations. (Daniels-Florida)
W80-05918

OIL AND GAS OPERATIONS IN THE ATLANTIC OUTER CONTINENTAL SHELF: AN OVERVIEW OF THE REGULATORY AND LITIGATION-RELATED CONSTRAINTS TO DEVELOPMENT,
G. D. C. Best.
Connecticut Law Review, Vol 11, No 3, p 459-481, Spring 1979.

Descriptors: *Continental shelf, *Atlantic ocean, *Oil industry, *Resources development, Leases, Federal government, Oil pollution, Legal aspects, Environmental effects, Federal jurisdiction, Legislation, State governments.

The history of oil and gas leasing and development in the Atlantic outer continental shelf (OCS) has been inhibited by regulatory and litigation-related constraints. From its inception, federal leasing in the frontier areas of the Atlantic OCS has generated controversy and provoked judicial challenge. A combination of factors has resulted in strong resistance to accelerated leasing by state officials, coastal communities, and affected interest groups. In addition to state and local resistance, any operator involved in OCS development must also deal with a complex regulatory scheme administered by a vast array of federal and state agencies whose statutory mandates are frequently inconsistent and

ambiguous. These numerous regulatory obstacles have led to much litigation. Courts are reluctant to grant injunctive relief where there is a public interest in a project or regulatory program. Recent legislation was drafted to obivate certain causes of public disaffection with the OCS leasing process. A significant effect has been increased state participation in all phases of the regulatory process. (Wilson-Florida)
W80-05919

AN ENVIRONMENTAL ASSESSMENT OF EMERGING INTERNATIONAL FISHERIES DOCTRINE,
J. Boak.
Columbia Journal of Environmental Law, Vol. 4, No. 1, p 143-166, Fall 1977.

Descriptors: *Fish management, *Marine fisheries, *International law, *Fish conservation, Economics, Concersation, Environmental effects, Legislation, Law of the sea, International commissions.

Recently worldwide interest has grown in the doctrines of international law governing the living sea resources. Due to a rising environmental consciousness in the United States, a decidedly conservationist view has developed. This view is embodied in the 1976 Fisheries Conservation and Management Act. The international regime is the conglomerate of doctrines developed by the actions of individual nations, agreements between nations, and various international agreements, and tends to be dominated by economic factors. An environmentally sound fiseries management regime should include the following standards: (1) maximum sustainable yield; (2) maximum economic yield; and (3) optimum sustainable yield. From an environmental standpoint, maximum sustainable yield has the most immediate appeal. There are three major approaches to fishery regulation: (1) unilateral action; (2) bilateral treaties or multilateral conventions; and (3) international treaties drafted by the Law of the Sea Conference. This latter method has the greatest potential for achieving fishery conservation goals. (Wilson-Florida)
W80-05920

LAW OF THE SEA - THE INTEGRATION OF THE SYSTEM OF SETTLEMENT OF DISPUTES UNDER THE DRAFT CONVENTION AS A WHOLE,
United Nations Secretariat.
A. O. Adede.
American Journal of International Law, Vol 72, No 1, p 84-95, January 1978.

Descriptors: *Law of the sea, *International waters, *Remedies, *Beds under water, International law, Water law, Judicial decisions, Economics, Foreign waters, Governmental interrelations, Governments, Jurisdiction.

An important aspect of the Convention on the Law of the Sea was to develop an effective and comprehensive system for the peaceful settlement of disputes which may arise from the interpretation and application of the Convention. This was the exclusive aim of the Revised Single Negotiating Text. The result was two separate systems: (1) dealing exclusively with seabed disputes; and (2) dealing with a comprehensive approach under the Convention as a whole. In 1976, the Seabed dispute system was integrated into the system for settling disputes on the whole. A Seabed Disputes Chamber of the Law of the Sea Tribunal was established and articles pertaining to its jurisdiction and settlement procedures were set forth. Limitations were placed on the applicability of the disputes-settlement section, to balance the needs of coastal states which need protection from vexatious claims with the need for peaceful judicial settlement of disputes. Arbitration was also offered as a procedure for dispute settlement. The result is a system whereby justiciable disputes are submitted to proper forums for peaceful settlement. (Tabano-Florida)
W80-05921

THE THIRD UNITED NATION'S CONFERENCE ON THE LAW OF THE SEA: THE 1977 NEW YORK SESSION,
Miami Univ., FL.
B. H. Oxman.
The American Journal of International Law, Vol 72, No 1, p 57-83, January 1978.

Descriptors: *United nations, *Law of the sea, *Continental shelf, International law, Regimes, Conferences, Resource allocation, International waters, Environmental controls, Economic impact, United Nations.

The Third United Nation's Conference on the Law of the Sea after the 1977 New York Session was on the verge of general agreement on the entire law of the sea except for deep seabeds. The deep seabed issue is briefly discussed. The Conference's work on other issues included: (1) three major 'received' regimes were accepted - the territorial sea (and contiguous zone), the continental seas and the high seas; (2) unimpeded transit through, over and under routes used for interational navigation was provided for connecting points outside coastal state 'sovereign' waters, irrespective of the extension of coastal states internal waters, territorial sea, or archipelagic waters embracing such routes; (3) optimum utilization of economiczoae fisheries and some revenue sharing from mineral exploitation of the continental margin beyond 200 miles became mandatory; and (4) broad new rules were adopted regarding the implementation of international environmental law. The first three parts will probably be regarded by many states as declaratory of international law. As to the latter action, opposition is likely, (Daniels-Florida)
W80-05922

THE WATER INDUSTRY IN SOUTH AFRICA,
South African Water Information Centre, Pretoria.
P. J. Aucamp.
1978. 43 p 7 Fig.

Descriptors: *Water management(Applied), *Planning, *Water resources, Water utilization, Water supply, Irrigation practices, Water conservation, Water demand, Public health, Water pollution, Industrial water, Waste water treatment, Radioactive wastes, Economics, *South Africa.

Responsibility for the supply of sufficient water for essential purposes and the promotion of effective use of this water in Soth Africa is in the hands of the Department of Water Affairs. Major subdivisions in the Department are: (1) Scientific Services, (2) Planning, (3) Works, l(4) Supervision, (5) Law Enforcement, (6) Administration and Finance, and (7) the South West African division. Research activities are designed to control water supplies to the best advantage of the entire population. Currently, approximately 40 projects are under construction in various parts of the country. Other departments involved in the South Africa's water industry are the Department of Health, the Department of Agricultural Technical Services, the Department of Forestry, and the South African Bureau of Standards. The Water Research Commission plays a major role in the area of research. Problem areas where research is being conducted include consumption, desalination, reclamation, effluents, and industrial consumption. Technology transfer and the promotion of the application of research results are also important functions of the Commission. The Council for Scientific and Industrial Research, composed of 16 nation research institutes and laboratories, and 25 research units, is also a major contributor to water research in the country. The Electric Supply Commission (ESCOM) and the Iron and Steel Industrial Corporation (ISCOR) are used to illustrate water and effluent management. Other areas discussed include the Rand Water Board, a bulk supplier of potable water; the Atomic Energy board; and Water pollution. (Seigler-IPA)
W80-05984

6G. Ecologic Impact Of Water Development

LIBBY DAM PROJECT: EX-POST FACTO ANALYSIS OF SELECTED ENVIRONMENTAL IMPACTS, MITIGATION COMMITMENTS, RECREATION USAGE AND HYDROELECTRIC POWER PRODUCTION,
Montana Univ., Missoula. School of Forestry.
V. A. Ciliberti, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-200090, Price codes: A08 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State Univ., Bozeman. Report No 106, 1980. 138 p, 22 Fig, 11 Tab, 131 Ref. OWRT A-106-MONT(1), 14-34-0001-0128.

Descriptors: *Dam construction, *Environmental effects, *Analysis, *Aquatic habitats, *Recreation demand, *Water quality, *Wildlife habitats, Hydroelectric power, Flood control, Peaking capacity, Reservoir operations, Streamflow, Sediment discharge, Water chemistry, Fish populations, Stage-discharge relations, Supersaturation, Temperature, Channel morphology, *Post-impoundment, *Libby Dam(MT), Kootenai River, *Montana, Lake Koocanusa, Fisher River, Wolf Creek, Post-construction analysis, Re-regulation dam, Stage fluctuations, Highway relocation, Railroad relocation.

Water impoundment projects generally impact the river below the dam. Frequently the construction contract provides for mitigation of adverse impacts. The Libby Project, authorized primarily for hydro-electric power generation and flood control and to provide navigation and recreation as secondary benefits, caused the inundation of a big-game winter range, the relocation of a railroad and a highway in addition to damming a river. The Army Corps of Engineers in cooperation with the Montana Department of Fish and Game and others engaged in a number of wildlife mitigation projects. The effects of the Libby Project on the Kootenai River and the degree of realization of the Wildlife mitigation were evaluated. Big-game mitigation is largely unsuccessful due to the increased frequency and magnitude of the river stage fluctuations. Nitrate and phosphate concentrations in the Kootenai River have been reduced. As a result of the channel alterations in Fisher River and Wolf Creek, substantial amounts of suspended sediment continue to be discharged into the Kootenai River. Recreation usage at the project site has been considerably below predictions but appears to be increasing. For water-years 1977 and 1978 electric power generation has been about 73% of initial projection. Generator use has averaged 47% with four turbines. The installation of 4 additional turbines at Libby Dam will reduce current average turbine use to 21%. Water diverted out of the Kootenai River in Canada will further reduce the turbine load factor.
W80-05794

PUBLIC INVOLVEMENT IN OFFSHORE OIL DEVELOPMENT: LESSONS FROM NEW ENGLAND,
Rhose Island Univ., Kingston. Coastal Resources Center.
For primary bibliographic entry see Field 6E.
W80-05900

OCS DEVELOPMEN: A NEW LAW AND A NEW BEGINNING,
House, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-05901

IRONDEQUOIT BAY DEVELOPMENT PLANNING: SOME IMPLICATIONS FOR INSTITUTIONAL REFORM,
For primary bibliographic entry see Field 6E.
W80-05911

BEACH ACCESS: AN HISTORICAL OVERVIEW,

For primary bibliographic entry see Field 6E.
W80-05912

THE ACQUISITION OF DEVELOPMENT RIGHTS IN THE COASTAL ZONE: AN ALTERNATIVE TO WETLANDS REGULATION,
For primary bibliographic entry see Field 6E.
W80-05913

7. RESOURCES DATA

7A. Network Design

ANALYSIS OF ARIZONA FLOOD DATA NETWORK FOR REGIONAL INFORMATION,
Geological Survey, Reston, VA. Water Resources Div.
G. D. Tasker, and M. E. Moss.
Water Resources Research, Vol 15, No 6, p 1791-1796, December 1979. 7 Fig, 1 Tab, 5 Ref.

Descriptors: *Regional analysis, *Arizona, *Flood data, *Networks, *Data collections, Model studies, Methodology, Regression analysis, Streamflow, Gaging stations, Flood forecasting, Flood frequency, Project planning, Costs, Feasability studies, *Northwest Arizona, *Network analysis, Regional information technique.

The technique known as Network Analysis for Regional Information is used for a network of stream-gaging stations in northwest Arizona in order to suggest a logical gaging strategy for the area. This procedure uses a Bayesian estimation scheme to arrive at the relationship between information content of a regional regression and the level of data availability (measured by the number of stations and harmonic mean record length). Superimposed on this relationship is the relationship between estimated network operating costs for planning periods of 10, 20, and 30 years for alternative gaging strategies. These relationships are used to develop the relationship between expected information content of the network and estimated cost of network operation, which, in turn, can be used to suggest the best gaging strategy to pursue in an uncertain future. (Kosco-USGS)
W80-05706

OVERVIEW OF CONFERENCE ON HYDROLOGIC DATA NETWORKS,
Geological Survey, Reston, VA. Water Resources Div.
W. B. Langbein.
Water Resources Research, Vol 15, No 6, p 1867-1871, December 1979. 17 Ref.

Descriptors: *Hydrologic data, *Network design, *Design criteria, *Research and development, Data collections, Costs.

The conference on hydrologic data networks dealt chiefly with the state of the art and current research on network design for the efficient and effective collection of useful data. Queries were raised about the difficulties in defining the objectives of a network, about the roles of optimization and of simplicity, about the use of information transfer, about the definition of network design, and why applications of research results have yet been few. The many different techniques that were espoused and discussed at the conference made it clear that network design does not involve a single formulation. The overriding message was also clear that some sort of systematic analysis is needed to assure that proliferating data networks achieve their scientific and social objectives. For this reason, recommendations were offered in the form of audits of existing data systems, and of plans for technological coordination to supplement ongoing operational coordination. (Kosco-USGS)
W80-05707

THE NATIONAL WATER DATA NETWORK: A CASE HISTORY,
Geological Survey, Reston, VA. Water Resources Div.
R. H. Langford, and F. P. Kapinos.
Water Resources Research, Vol 15, No 6, p 1687-1691, December 1979. 4 Fig, 6 Ref.

Descriptors: *Hydrologic data, *Network design, *Data collections, *Water resources, *Planning, Methodology, Evaluation, Surface waters, Groundwater, Water quality, Monitoring, Information retrieval, Analytical techniques, Coordination, *Office of Water Data Coordination(OWDC), *National Water Data Network.

In 1964, the Bureau of the Budget (now the Office of Management and Budget) issued Circular A-67 to coordinate water-data acquisition activities by Federal agencies. Under Circular A-67, the Department of the Interior's Office of Water Data Coordination (OWDC) has the responsibility to: (1) Maintain a catalog of information on water data; (2) undertake a continuing review of water-data requirements; (3) prepare a Federal plan for efficient utilization of water-data activities; and (4) design a national water data network. A concept of three levels of information was developed as the rationale for national network planning. The three levels are: Level I--a base level of information for national and regional planning and assessment; level II--data needs for subregional planning and assessment; and level III--data for operation and management at the local level. Several elements of level I of the national network have been totally or partially implemented, including: (1) The streamflow and stream-quality accounting elements; (2) the water-use accounting element; (3) the water-quality surveillance element; and (4) the flood surveillance element. The National Water Data Network is coordinated through an interagency process involving more than 30 Federal agencies and numerous non-Federal organizations interested in water-data acquisition. As part of this coordination process, the Catalog of Information on Water Data is maintained and is used as the basis for planning the operation of the network. Through the National Water Data Exchange (NAWDEX), established as an outgrowth of the coordination activity, the water-data information base is being expanded continually. (Kosco-USGS)
W80-05708

SOME BASIC CONSIDERATIONS IN THE DESIGN OF HYDROLOGIC DATA NETWORKS,
Geological Survey, Reston, VA. Water Resources Div.
M. E. Moss.
Water Resources Research, Vol 15, No 6, p 1673-1676, December 1979. 24 Ref.

Descriptors: *Network design, *Hydrologic data, *Data collections, *Evaluation, Regional analysis, Forecasting.

Two considerations of data network design are the random nature of the hydrologic phenomena and the uses that will be made of the data. Information from the data is usually measured in a parametric statistical sense, although the data user is more concerned with the integrated measure of information--what impact does the lack of perfect hydrologic information have on the ensuing decisions. The efficiency of the data collection and the effectiveness of the resulting information, must be integrated to achieve a complete network design.
W80-05709

SPACE, TIME, AND THE THIRD DIMENSION (MODEL ERROR),
Geological Survey, Reston, VA. Water Resources Div.
M. E. Moss.
Water Resources Research, Vol 15, No 6, p 1797-1800, December 1979. 8 Fig, 5 Ref.

Descriptors: *Model studies, *Hydrologic data, *Data collections, *Network design, Statistical methods, Regional analysis, Regression analysis, Streamflow forecasting, Estimating, *Model error, *Space-time tradeoff, *Network Analysis for Regional Information.

The space-time tradeoff of hydrologic data collection (the ability to substitute spatial coverage for temporal extension of records or vice versa) is controlled jointly by the statistical properties of the phenomena that are being measured and by the model that is used to meld the information sources. The control exerted on the space-time tradeoff by the model and its accompanying errors has seldom been studied explicity. The technique, known as Network Analyses for Regional Information (NARI), permits such a study of the regional regression model that is used to relate streamflow parameters to the physical and climatic characteristics of the drainage basin. The NARI technique shows that model improvement is a viable and sometimes necessary means of improving regional data collection systems. Model improvement provides an immediate increase in the accuracy of regional parameter estimation and also increases the information potential of future data collection. Model improvement, which can only be measured in a statistical sense, cannot be quantitatively estimated prior to its achievement; thus an attempt to upgrade a particular model entails a certain degree of risk on the part of the hydrologist. (Kosco-USGS)
W80-05713

WATER RESOURCES ACTIVITIES IN ILLINOIS, 1979,
Geological Survey, Champaign, IL. Water Resources Div.
D. E. Winget, and M. L. Garrelts.
Geological Survey Illinois District Report, 1979. 51 p.

Descriptors: *Illinois, *Water resources, *Projects, *Water year, *Reviews, Surface waters, Groundwater, Programs, Data collections, Streamflow, Discharge(Water), Floods, Water quality, Hydrology, Sampling, Measurement, Sites, Project type, Project objective, Project approach, Project progress.

This report details the activities of the U.S. Geological Survey, Water Resources Division in Illinois. Part A of the report contains two tables. One table shows station numbers, names, and types of data collected for surface-water stations. Another table shows station numbers, well numbers, ownership, and type of data collected for ground-water stations. Ground-water stations are grouped by counties. Part B contains a brief outline of the status of water-resources projects in progress in Illinois during 1979 water year. (Kosco-USGS)
W80-05715

7B. Data Acquisition

SATELLITES AS AID TO WATER RESOURCE MANAGERS,
National Environmental Satellite Service, Washington, DC.
D. F. McGinnis, Jr., R. A. Scofield, S. R. Schneider, and C. P. Berg.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 106, No WR1, Proceedings Paper 15244, p 1-19, March 1980. 14 Fig, 1 Tab, 17 Ref, 1 Append.

Descriptors: *Remote sensing, *Water resources, *Satellites(Artificial), *Water management(Applied), Snow, Snow cover, Snow surveys, Floods, Rivers, Ice, Ice cover, Rainfall, Storms, Hurricanes, Data processing, Mapping.

Satellite imagery and digital data have been applied to solve water resource problems. Areal snowcover determinations, monitoring of river ice breakup, mapping of flood extent, and precipitation estimates have been derived from polar-orbiting and geostationary satellite data. The operational snowmapping program at the National Environmental Satellite Service provides snowcover data to requesting federal, state, and local agencies for use in reservoir release decisions, water resource planning, flood forecasting, and runoff modeling. Satellite data can be used to monitor ice breakup on major river systems. During April 4-14, 1976,

lengths of individual ice-covered reaches on Canada's Ottawa River were measured daily. Major floods in the United States have been observed on satellite imagery and flood-extent maps produced. Case studies were presented for the Mississippi River flood of 1973 and the Red River of the North flood of 1978. (Sims-ISWS)
W80-05731

THERMOGRAPHY FOR ESTIMATING NEAR-SURFACE SOIL MOISTURE UNDER DEVELOPING CROP CANOPIES,
South Dakota State Univ., Brookings, Remote Sensing Inst.
J. L. Heilman, and D. G. Moore.
Journal of Applied Meteorology, Vol 19, No 3, p 324-328, March 1980. 5 Fig, 10 Ref. NASA NAS5-24206.

Descriptors: *Remote sensing, *Soil moisture, *Crops, Satellites(Artificial), Aircraft, Infrared radiation, Canopy, Soils, Moisture content, Soil water, Temperature, Soil temperature, Air temperature, Agriculture, Crop canopy.

Previous investigations of thermal infrared techniques using remote sensors (thermography) for estimating soil water content have been limited primarily to bare soil. Ground-based and aircraft investigations were conducted to evaluate the potential for extending the thermography approach to developing crop canopies. A significant exponential relationship was found between the volumetric soil water content in the 0-4 cm soil layer and the diurnal difference between surface soil temperature measured at 0230 and 1330 LST (satellite overpass times of NASA's Heat Capacity Mapping Mission--HCMM). Surface soil temperatures were estimated using minimum air temperature, percent cover of the canopy, and remote measurements of canopy temperature. Results of the investigation demonstrated that thermography can potentially be used to estimate soil temperature and soil moisture throughout a complete growing season for a number of different crops and soils. (Sims-ISWS)
W80-05768

PRELIMINARY ASSESSMENT OF DIFFERENT METHODS FOR BEDROCK WATER WELL LOCATION AND EVALUATION,
Vermont Univ., Burlington. Dept. of Geology.
W. Wagner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-200116, Price codes: A08 in paper copy, A01 in microfiche. Vermont University Technical Report, 1979, 26 p. 107 Fig, 9 Ref, 2 Append. OWRT A-030-VT(1), 14-34-001-9048.

Descriptors: *Groundwater, *Groundwater availability, *Geophysical surveys, *Water wells, *Bedrock, Geophysical, Groundwater potential, Hydrogeology, Logging, Electrical well logging, On-site investigations, Mapping, Borehole geophysics, Magnetic studies, Fracture permeability, *Vermont, Proton precession magnetometer.

The purpose of this study is to evaluate the use of a proton precession magnometer for locating fractures in bedrock having a potential for high yield water wells, and geophysical bore hole logging (caliper, electric, and gamma ray) of wells to assess their profile characteristics and the possibility for guiding modifications intended to produce higher yields. Field testing of more than 21 different sites with the magnetometer and 23 individual wells provided extensive data from different geologic, hydrologic, and man-made conditions. Magnetic surveys in many but not all cases reveal the presence of bedrock fractures by a linear positive magnetic anomaly. These anomalies in some cases correspond with fracture (question)-trace linears on aerial photographs. They were also related to dikes, faults and manmade features with less certain but possibly important influences by metamorphic foliation. The cause(s) of anomalies over fracture (question)-trace is not known. A definite correlation between magnetic anomalies and groundwater is found. Different methods for locating water wells by magnetic surveys are evaluated and, in general, show definite promise. Caliper and resistivity logs from bore hole logging surveys show significant relationships to water bearing fractures; gamma ray logs show no such relationships. This study shows that both high and low yield wells may penetrate rock which is heavily fractured. The potential for using logs to characterize the degree of fracturing is good, but not for distinguishing water bearing versus non-water bearing fractures.
W80-05792

FLOWS ABOVE OSCILLATORY RIPPLES,
Research Inst. for Applied Mechanics, Fukuoka (Japan).
H. Honji, A. Kaneko, and N. Matsunaga.
Sedimentology, Vol 27, No 2, p 225-229, April 1980. 7 Fig, 12 Ref.

Descriptors: *Hydraulic models, *Flow separation, *Vortices, *Sand waves, Erosion, Laboratory tests, Model studies, Foreign research, Methodology, Ripple marks, Laboratory equipment, Beds under water, Oscillatory flow, Water tunnel, Flow visualization.

The flows above ripples of glass beads and ripple models were visualized in an oscillatory water tunnel. The experiments were carried out using a closed-type 3 m water tunnel, of which a horizontal test section was 120 cm in length and 15 cm in width and in height. Water in the tunnel was oscillated by a motor-driven piston. Flows were visualized by means of the methods of direct shadow, dye generation, and suspension of aluminum flakes. Flow patterns were photographed with a 35 mm camera at rest with respect to the tunnel. Some ripples were observed to form without flow separation. Two types of vortices, the standing vortices without flow separation and the separation vortices, were observed, and their similarity was discussed. (Humphreys-ISWS)
W80-05852

RAPID DETERMINATION OF SOIL WATER CHARACTERISTIC BY THERMOCOUPLE PSYCHROMETRY,
Soil Conservation Service, Price, UT.
For primary bibliographic entry see Field 2G.
W80-05871

RECENT VEGETATION CHANGES ALONG THE COLORADO RIVER BETWEEN GLEN CANYON DAM AND LAKE MEAD, ARIZONA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2I.
W80-05880

DETERMINATION OF LAND USE FROM LANDSAT IMAGERY: APPLICATIONS TO HYDROLOGIC MODELING,
Hydrologic Engineering Center, Davis, CA.
Research Note No 7, November 1979. 75 p 22 Fig, 36 Tab, 24 Ref, 3 Append.

Descriptors: *Land use, *Remote sensing, *Hydrology, *Analytical tecniques, Model studies, Satellites(Artificial), Watersheds(Basins), Mapping, Surveys, Forests, Water, Pastures, Ranges, Quarries, Runoff, Discharge(Water), Frequency curves, LANDSAT, Residential area.

An operational procedue for determining land use from LANDSAT imagery was applied to five watersheds: Crow Creek, Walnut Creek, Rowlett Creek, Pennypack Creek, and Castro Valley (University of California, Davis (UCD) staff performing the work on the latter three watersheds). Based on this work the following conclusions can be made: (1) At the grid cell level LANDSAT land use was in error approximately one-third of the time. (2) By aggregating land use over the entire watershed, LANDSAT's average misclassification of land use reduces to 2-8% for the major land use categories. (3) The commercial classification was less accurate at the grid cell level than the UCD procedure classification; errors at the watershed level were nearly the same for both. (4) Evaluated in terms of the difference in discharge frequency curves derived using the same hydrologic model but different land use (LANDSAT and conventional), the LANDSAT derived land use fond to be completely adequate. The number and type of land use categories derived from LANDAT data were sufficient to be able to apply two standard hydrologic modeling techniques: Snyder's unit hydrograph with percent imperviousness and the SCS curve number method. (5) The UCD procedure works. It is a complete, self-contained package of computer programs and manual operations that permit a user to identify land use from LANDSAT digital data without requiring the use of expensive interactive image processing equipment. (6) LANDSAT land use can be directly incorporated into a grid cell data bank, thus providing and automated environment for applying the LANDSAT classification in routing hydrologic investigations. (Humphreys-ISWS)
W80-05931

FLUIDIZED BED ELUTRIATION OF CARBONATE SANDS,
Cambridge Univ. (England). Dept. of Chemical Engineering.
B. Cooker, and R. Goodwin.
Sedimentology, Vol 27, No 2, p 219-224, April 1980. 4 Fig, 29 Ref.

Descriptors: *Separation techniques, *Sediments, *Sedimentology, *Grading, Particle size, Sands, Carbonates, Settling velocity, Laboratory tests, Methodology, Analytical techniques, Analysis, Laboratory equipment, Instrumentation, Elutriation, Fluidized beds.

Elutriation from a fluidized bed provides an accurate, economical, direct method of sediment grading by terminal velocity. This is of particular value in studying populations of irregular particles in the range medium sand to granual (e.g., carbonate sands). A column suitable for such material (terminal settling velocity 1-30 cm/s) was described. The elutriator forces water through the sample under study, which in the absence of flow exists as a static bed at the base of a tube which is 2 m long. This length is sufficient to contain the fully expanded bed at the higher flow rates so that the exit tubes only receive elutriated material. The fine mesh of the distributor and the small scale of the particles (0.5-5 mm) compared with the tube diameter (10 cm) ensure that the flow of fluid through the bed is uniform. The pressure drop through the bed cause flow; this pressure drop increases with the fluid velocity. As the pressure is increased, a value is eventually reached where the resistance between the fluid and bed rises to the weight of the latter and fluidization begins. In this regime, all the particles are in motion in the bed only the finest material in swept up into the body of the tube, the flow velocity being greater than the terminal settling velocity of these particles. Sample results from Connemara Lithothamnion beach material were given. (Humphreys-ISWS)
W80-05935

7C. Evaluation, Processing and Publication

WATER RESOURCES ACTIVITIES IN ILLINOIS, 1979,
Geological Survey, Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-05715

HYDROGEOLOGIC DATA FROM THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
S. E. Slagle, and J. R. Stimson.
Available from OFSS Bx 25425, Fed. Ctr. Denver, CO., paper copy $16.00, microfiche $4.00. Geological Survey open-file report 79-1332 (WRI), December 1979. 111 p, 2 Fig, 1 Plate, 3 Tab, 6 Ref.

Descriptors: *Hydrogeology, *Basic data collections, *Montana, *Groundwater resources, Coal

mines, Effects, Water resources development, Water wells, Well data, Aquifers, Water levels, Water utilization, Specific conductivity, Water temperature, *Northern Powder River basin, *Southeastern Montana.

Hydrologic and geologic data have been collected as part of energy-related projects conducted by the U.S. Geological Survey in the northern Powder River basin of southeastern Montana. Records of 1924 stock, domestic, irrigation, public supply and test wells are tabulated in the report. The data include well location, depth of well, casing diameter, type of lift, type of power, use of water, principal aquifer, altitude of land surface, water level, discharge, field specific conductance, and water temperature. Locations of the inventoried wells are shown on a map at a scale of 1:500,000. Lighologic logs of 373 wells and test holes are also included. The geologic units considered range in age from Late Cretaceous to Holocene. (Kosco-USGS)
W80-05718

BACKWATER AT BRIDGES AND DENSELY WOODED FLOOD PLAINS, YOCKANOOKANY RIVER NEAR THOMASTOWN, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W80-05721

A SUMMARY OF MEASURED HYDRAULIC DATA FOR THE SERIES OF STEADY AND UNSTEADY FLOW EXPERIMENTS OVER PATTERNED ROUGHNESS,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-05722

THE PATTERN OF NATURAL SIZE DISTRIBUTIONS,
Rickwoods and Mark Beech, Edenbridge (England).
R. A. Bagnold, and O. Barndorff-Nielsen.
Sedimentology, Vol 27, No 2, p 199-207, April 1980. 10 Fig, 17 Ref.

Descriptors: *Particle size, *Histograms, *Sediment distributions, *Mathematical models, Distribution, Statistical methods, Analytical techniques, Equations, Probability, River beds, Bottom sediments, Glacial sediments, Sands, Saltation, Duen sands, Theoretical analysis, Normal distribution, Marine sediments, Hyperbolic distributions.

The pattern of empirical distributions, in particular size distributions, is often best brought out by drawing a log-histogram. The Gaussian or 'normal' distribution furnishes a description of the empirical distribution if the log-histogram approximates to a parabola. In many cases, however, the log-histogram is far from parabolic but may be closely approximated by a hyperbola. It is therefore natural to consider those theoretical probability distributions for which the graph of the log-probability (density) function is a hyperbola. The theory and applicability of such hyperbolic distributions have been the subject of a number of recent investigations, and it was the purpose of this paper to summarize these developments with regard to the interest they may have to sedimentologists. A precise description of the hyperbolic distributions was given, and their wide applicability was indicated. Methods for fitting these distributions to data were discussed, and a number of sedimentological examples were presented. Furthermore, the question of finding dynamical explanations for the occurrence of the hyperbolic shape was considered from various points of view. (Humphreys-ISWS)
W80-05853

ANALYSES OF NATIVE WATER, BOTTOM MATERIAL, AND ELUTRIATE SAMPLES OF SOUTHERN LOUISIANA WATERWAYS, 1977-78,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W80-05867

WATER RESOURCES DATA FOR MASSACHUSETTS AND RHODE ISLAND, WATER YEAR 1978,
Geological Survey, Boston, MA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116098, Price codes: A13 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MA-RI-78-1, July 1979. 299 p, 5 Fig, 1 Tab, Append.

Descriptors: *Massachusetts, *Rhode Island, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for the 1978 water year for Massachusetts and Rhode Island consist of records of stage, discharge, and water quality of streams; contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 105 gaging stations, monthend contents for 30 lakes and reservoirs, water qualtiy for 23 gaging stations, and water levels for 111 observation wells. Also included are data for 18 low-flow and 22 crest-stage partial record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States are also included in this report. These data represent that portion of the National Water Data System operated by the U.S. Geolgocial Survey and cooperating State and Federal agencies in Massachusetts and Rhode Island. (Kosco-USGS)
W80-05868

WATER RESOURCES DATA FOR MISSOURI, WATER YEAR 1978,
Geological Survey, Rolla, MO. Water Resources Div.
Geological Survey Water-Data Report MO-78-1, August 1979. 300 p, 3 Fig.

Descriptors: *Missouri, *Hydrologic data, *Surface waters, *Groundwater, *Water quallity, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lake, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Missouri consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 119 gaging stations, stage only at 3 gaging stations, stage and contents at 6 lakes and reservoirs, water quality at 29 gaging stations (including 1 lake) and 3 wells. Also included are data for 89 crest-stage and 28 water-quality partial-record stations. (Kosco-USGS)
W80-05869

MAPS SHOWING GROUND-WATER CONDITIONS IN THE NORTHERN PART OF THE GILA RIVER DRAINAGE FROM PAINTED ROCK DAM TO TEXAS HILL AREA, MARICOPA, PIMA, AND YUMA COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, AZ. Water Resources Div.
N. D. White, S. A. Leake, and D. M. Clay.
Available from OFSS, Box 25425, Fed. Ctr. Denver, CO. 80225, Paper copy $14.25, microfiche $1.50. Geological Survey open-file report 79-1537 (WR), September 1979. 3 sheets, 11 ref.

Descriptors: *Maps, *Groundwater, *Arizona, Drainage wells, *Pumping, Water wells, Irrigation, Water levels, Water quality, Specific conductivity, Fluorides, Aquifer characteristics, Water level fluctuations, Hydrographs, *Gila River(AR), Maricopa County(AR), Pima County(AR), Yuma County(AR).

The Gila River drainage from Painted Rock Dam to Texas Hill area includes about 3,000 square miles in southwestern Arizona. Ground-water development has taken place only in the northern part of the area, and only this part is included in the report. The southwestward-flowing Gila River drains the 1,900-square-mile northern part of the area. The main water-bearing unit is the valley-fill deposits. Since 1967, the estimated ground-water pumpage has exceeded 100,000 acre-feet per year, and in 1977 the ground-water pumpage was 210,000 acre-feet; the ground water is used mainly for irrigation. The ground-water withdrawals have resulted in general water-level declines in most of the area. Information shown on the maps includes change in water level, 1965-78 and 1973-78, and irrigated area; depth to water, altitude of the water level, and well depth; and specific conductance and fluoride concentration in the water. Hydrographs of the water level in selected wells and a table of historical pumpage also are included. Scale 1:250,000. (Kosco-USGS)
W80-05882

MAPS SHOWING GROUND-WATER CONDITIONS IN THE GILA RIVER DRAINAGE FROM TEXAS HILL TO DOME AREA AND IN THE WESTERN MEXICAN DRAINAGE AREA, MARICOPA, PIMA, AND YUMA COUNTIES, ARIZONA--1977.
Geological Survey, Tucson, AZ. Water Resources Div.
S. A. Leake, and D. M. Clay.
Available from OFSS, Box 25425, Fed. Ctr. Denver Co. 80225, Paper copy $10.75, microfiche $1.50. Geological Survey open-file report 79-1540 (WR(), September 1979. 3 Sheets, 14 Ref.

Descriptors: *Maps, *Groundwater, *Drainage wells, *Arizona, *Water levels, Imported water, Colorado River, Water table, Irrigation, Water wells, Water yield, Water quality, Water analysis, Specific conductivity, Fluorides, *Gila River(AR), Maricoa County(AR), Pima County(AR) Yuma County(AR).

The Gila River drainage from Texas Hill to Dome and the western Mexican drainage areas include about 4,700 square miles in southwestern Arizona. The main water-bearing unit is the alluvium along the Gila River and its tributaries and in the valleys that separate the mountains. Most of the groundwater development has taken place in the Wellton-Mohawk area in the northern part of the Gila River drainage from Texas Hill to Dome area. The use of imported Colorado River water for irrigation caused the water levels to rise, and in the early 1970's the water levels were within 6 feet of the land surface in most of the area. Since 1961, a network of about 70 wells has been pumping about 200,000 acre-feet of ground water annually for drainage of the waterlogged land in the area. The ground water in the Wellton-Mohawk area is of unsuitable chemical quality for most uses. Information shown on the maps includes depth to water, well depth, altitude of the water level, irrigated area, and specific conductance and Fluoride concentration in the water, A table of historical pumpage also is included. Scale 1:125.000. (Kosco-USGS)
W80-05883

DETERMINATION OF LAND USE FROM LANDSAT IMAGERY: APPLICATIONS TO HYDROLOGIC MODELING,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 7B.
W80-05931

SOURCES OF COMPUTER PROGRAMS IN HYDRAULICS,
American Society of Civil Engineers, New York. Hydraulics Div.
For primary bibliographic entry see Field 2A.
W80-05948

8. ENGINEERING WORKS

8A. Structures

PALEONTOLOGICAL RESOURCES EVALUATION: RED FLEET RESERVOIR,
Robertson Research (U.S.) Inc., Houston, TX.
R. E. Sloan, J. H. Hartman, L. J. Dempsey, M. E. Jordon, and E. B. Robertson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-204258, Price codes: A04 in paper copy, A01 in microfiche. Final Report prepared for Water and Power Resources Service, March 1980. 52 p, 17 Fig, 28 Ref, 2 Append. 9-07-40-S0811.

Descriptors: *Utah, *Geological surveys, *Archaeology, *Sedimentary rocks, Reservoirs, *Preimpoundment, Structural geology, Sedimentary structures, Sedimentology, Geology, Literature reviews, Paleontology, Dinosaurs, Dam sites, *Red Fleet Reservoir(UT).

A thorough literature review and a field survey were conducted to evaluate fossil occurrences, or potential of the rock formations below the reservoir take line of the Red Fleet Reservoir, Vernal, Utah. The reservoir is being constructed on Big Brush Creek on the south slope of the eastern Uinta Range and will flood a considerable area with a take line at 1,712 m of elevation. Rock units in and around the area are of sedimentary origin with formations representing Mesozoic, Jurassic, and Cretaceous age groups. No record was found in literature of paleontological surveys within the boundaries of the reservoir, but important investigations in the general area were found. Significant collections of Jurassic vertebrates have been documented nearby at Dinosaur National Monument. A field survey of the entire reservoir area was conducted in July of 1979 by vehicle, on foot, and by the use of aerial photographs. Reference sections were established to illustrate rock unit relationships. Morrison Formation units were extensively studied because they were known to have the greatest potential. Although fossil material was uncovered from several rock formations, it does not appear to be of significant scientific value. Fossil material identified included invertebrates from several horizons and disarticulated dinosaur bone material. Based on the lack of significant findings, no mitigation measures are recommended. Fossil materials located will be displayed at the Uintah Museum of Natural History or at a dam site interpretive center. (Seigler-IPA)
W80-05761

UMTATA RIVER PROJECT WILL HAVE 17 MW CAPACITY,
Construction in South Africa, Vol 23, No 5, p 48-49. August 1978, 3 Fig.

Descriptors: *Hydroelectric power, *South Africa, *Hydraulic turbines, Weirs, Hydraulic structures, Concrete structures, Engineering structures, Gates, Flumes, Cofferdams, Penstocks, Dams, Remote control, Flood control.

A 17 MW hydro-electric scheme is being constructed near Umtata, the capial of Transkei, at a cost of 13.5 million. The scheme will provide a peak load shedding capabiility and plans call for eventual capacity expansions to 34 NW. Construction of the project is being done by the low bidder. Alfred McAlpine and Son (PTY) Ltd. Two sites, First Falls and Second Falls, are involved in the project. At each site new power stations will be built to replace the old 1 MW existing stations. First Falls will have 2--3 MW generators and Second Falls will have 2--5.5 NW generators. Each site will also have a concrete weir, an intake structure, and a steel penstock. A 66 KV transmission line will be constructed from Second Falls by First Falls to the Zimbane sub-station at Umtata. At First Falls a 23 m head difference will exist between the intake and turbines and at Second Falls, a 46 m head difference. At each station there will be mass concrete in the base and surrounding the turbine intake. The scheme will be characterized by a high degree of automation and the power stations will be basically unmanned. The project is expected to reduce the cost of electricity purchased by Transkei from Escon. (Seigler-IPA)
W80-05990

THE DRAKENSBERG PUMPED STORAGE SCHEME,
The Civil Engineer in South Africa, Vol 21, No 1, p 20-21, January 1979, 2 Fig.

Descriptors: *Hydroelectric plants, *Hydraulic turbines, *Pumped storage, *Underground powerplants, Hydroelectric power, Reservoir storage, Water supply, Engineering structures, Rock bolts, Rock excavation, Tunnel construction, Underground structures, Shafts(Excavations), *South Africa.

The Drakensberg Pumped Storage Scheme, located at the foot of Drakensberg near the Oliviershoek Pass, 35 km from Bergville, is one of the biggest in the world. It is a joint undertaking of the Electricity Supply Commission and the Department of Water Affairs. It is also Escom's first pumped-storage scheme. Water stored during off-peak periods will generate power during peak hours for the national grid and pump water to the Tugela Basin to supplement the water supply of the Witwatersrand. The primary civil contractor for the scheme is Drakon, a joint venture between LTA Construction and Shaft Sinkers. The complete works for the scheme will be located underground with only the Kilburn Damwall, lift shaft buildings, trasmission lines, and access roads being visible. Underground there will be a main complex with three halls, one each for valves, machines, and transformers. The machine hall will have four 250 MW reversible generator/motors connected to reversible turbine/pumps. This will give a 1,000 MW generating capacity during peak periods, Generating mode water will be drawn from the Driekloof Dam, through a tunnel system, through the power station, and will be discharged into the Kilburn Dam. This flow will be reversed for pumping. Materials used will include 175,000 cu m of concrete, 600 rubber guniting hoses, rock bolts, dowels, wiremesh, and shotcrete. Lasers are being used to control line and grade. (Seigler-IPA)
W80-05992

SWAZILAND DAM,
For primary bibliographic entry see Field 8C.
W80-05997

R18 MILLION PROJECT IN SWAZILAND,
The Civil Engineering Contractor (Johannesburg) Vol 13, No 6, p 13-20, March 1979, 6 Fig.

Descriptors: *Dam construction, *Irrigation water, *Canal construction, Engineering structures, Excavation, Concrete-lined canals, Dam design, Damsites, Sugarcane, Sugar crops, Riprap, Diversion structures, Dam foundatons, *South Africa.

The Fairview Dam, officially the Mnjoli Dam, will supply water for the cane plantations, mill, and associated townships of Swaziland's third sugar mill, a part of the country's 20 year old industry of 200,000 t of sugar per annum. The dam is located in the Tshaneni district and is part of the Imbuluzi Irrigation Scheme. The dam itself will cost R11-million and will restrain a volume of 155-million cu m of water. At full supply level it will cover 1,900 ha of surface area. The design of the dam calls for nine zones, two outer shell zones, two clay core zones, two filter zones, and one riprap zone. Construction is being done by S. Hilton-Barber (Swaziland) (Pty) Ltd, a subsidiary of Grinaker Holdings Ltd. After the river was diverted there was a tight schedule for the completion of the dam to the point where the da could withstand over-topping as a result of a 1 in 100 year flood. However, this state of completion was reached three weeks ahead of schedule. By the time the dam is completed, approximately 4.4 million cu m of material will have been moved. This total will include the establishment of roads and the clearing of building sites. During construction the river proved to be a problem by washing away the causeway three times. The project also involves the construction of a 45 Km canal, a balance reservoir, and an inverted syphon. (Seigler-IPA)
W80-05999

8B. Hydraulics

POWER FROM WAVES USING HARBOR RESONATORS,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 2L.
W80-05732

LATERAL WEIR FLOW MODEL,
Concordia Univ., Montreal (Quebec). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-05733

FRICTION SLOPE MODELS FOR M2 PROFILES,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
R. A. Chadderton, and A. C. Miller.
Water Resources Bulletin, Vol 16, No 2, p 235-242, April 1980. 4 Fig, 6 Tab, 13 Ref.

Descriptors: *Flow, *Flow friction, *Surfaces, *Model studies, Mathematical models, Equations, Channels, Channel flow, Friction, Hydraulics, Water surface profiles, Friction slope averaging, Standard step method.

Results of studies that have considered the relative merit of various friction slope averaging equations previously used in water surface profile computations were described. Limitations of the most accurate equation known for the M2 profile have indicated that a new equation which gives more emphasis to the upstream energy gradient was desirable. Based upon friction slope curves developed for M2 water surface profiles, two new equations, one a parabolic and the other an elliptical approximation, were presented. The behavior of the new equations and of the previously most recommended equation was described by test calculations. The elliptical equation performed more satisfactorily than the harmonic method commonly recommended for M2 profile computations. Insertion of an additional cross-section about 50 feet upstream from a critical depth section was found to reduce computational errors for any energy gradient averaging method. (Sims-ISWS)
W80-05817

FRICTION FACTORS IN STORM SURGES OVER INLAND AREAS,
Water Resources Engineers, Springfield, VA.
For primary bibliographic entry see Field 2L.
W80-05825

WAVE RUNUP ON VARIABLE BEACH PROFILES,
Tetra Tech, Inc., Jacksonville, FL.
For primary bibliographic entry see Field 2L.
W80-05826

NUMERICAL ANALYSIS OF WIDE-ANGLED DIFFUSERS IN TURBULENT FLOW,
MATEC, Milan (Italy). Modelli Matematici.
R. Sala, P. L. Vivarelli, and G. Garuti.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Proceedings Paper 15402, p 629-647, May 1980. 16 Fig, 17 Ref, 2 Append.

Descriptors: *Diffusion, *Turbulent flow, *Numerical analysis, *Mathematical models, Model studies, Flow, Turbulence, Energy, Hydraulics, *Diffusers.

The mathematical model of steady turbulent flow in wide-angled conical diffusers was presented. Static pressure distribution resulting from the numerical solutions was more flattened than the experimental data due to the underestimation of

normal turbulent stresses. On the contrary, the shear stresses were generally overestimated; the opposing effects of the stresses counterbalance in the mean kinetic energy and momentum analysis. The spatial distribution of stream lines was well predicted as well as the detailed characteristics of recirculating region, as a result of the choice of the wall function. The discrepancies in the predictions of some quantities confirm the need to refine the turbulence modeling when recirculating regions were present, as in wide-angled diffusers. (Sims-ISWS)
W80-05848

HYDRAULIC EFFECTS OF RECHARGING THE MAGOTHY AQUIFER, BAY PARK, NEW YORK, WITH TERTIARY TREATED SEWAGE,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 5D.
W80-05884

HYDRAULIC DESIGN OF FLOW DISTRIBUTION CHANNELS,
Montgomery (James M.) Inc., Pasadena, CA.
J. L. Chao, and R. R. Trussell.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 106, No EE2 Proceedings Paper 15317, p 321-334, April 1980. 7 Fig, 4 Tab, 11 Ref, 1 Append.

Descriptors: *Flow, *Channel flow, *Water treatment, *Waste water treatment, Flow separation, Weirs, Design, Hydraulics, Channels, Mathematical models, Model studies, Flow distribution, Flow distribution channels, Entrances(Fluid flow).

A method to analyze flow distribution over side weirs in a flow distriblution channel was presented. It was found that the discharge coefficient for individual side weirs is not constant but varies with local channel Froe number. A step-by-step procedure was developed to calculate the flow distribution, and an illustrative example was provided. It was suggested that the two most viable alternatives for providing a uniform flow distribution over side weirs were the use of a very wide feed channel with weirs of uniform design or employment of a tapered channel. Mixing may be required in the former to prevent sedimentation. (Sims-ISWS)
W80-05947

BIOFILM GROWTH AND HYDRAULIC PERFORMANCE,
Argonne National Lab., IL.
B. F. Picologlou, N. Zelver, and W. G. Characklis.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY5, Proceedings Paper 15421, p 733-746, May 1980. 11 Fig, 2 Tab, 16 Ref, 2 Append. NSF ENG74-11957, ENG77-26934.

Descriptors: *Slime, *Pipe flow, *Roughness(Hydraulic), *Laboratory tests, Pipelines, Fouling, Fluid friction, Films, Biological properties, Microbiology, Energy loss, Water supply, Hydraulics, Biofilms, Biofouling.

An experimental investigation of the deleterious effect of microbial slime layers on the hydraulic performance of water conduits was presented. The underlying mechanisms that lead to an increase of frictional losses in the conduit were explored, and their relative importance was discussed. It was shown that although the slime layer is viscoelastic and filamentous, its effect on frictional resistance can be adequately represented through an increase in rigid equivalent sand roughness of the conduit wall. (Sims-ISWS)
W80-05953

8C. Hydraulic Machinery

GETTING WATER FROM A BOREHOLE,
N. Snyman.
Farmer's Weekly (Mobeni. Natal), p 38-42, December 21, 1977, 4 Fig, 3 Tab.

Descriptors: *Boreholes, *Pumps, *Wells, *Centrifugal pumps, Pumping, Pump turbines, Hydraulic machinery, Water conveyance, Pump testing, Impellers, Wind velocity, Water wells, Casings, Pipes.

The various types of pumps suitable for raising water from a borehole are described along with their advantages and constraints. Almost all of the pumps require a borehole with a diameter of at least 150 mm. Other factors to be considered with all of the pump types include the depth to which the pump should be inserted, the amount of water to be pumped, and whether or not the borehole is straight. Reciprocating pumps involve an up-and-down movement that moves a plunger inside a cylinder. Windmills can be used to drive reciprocating pumps. Windmill wheel diameters range from 1.8 m to 7.6 m. Three basic types of windmills are the geared head where the wind shaft has pinions driving gear wheels, direct-acting gearless heads, and the rotary windmill. Another type of pump is the centrifugal pump that lifts water due to the centrifugal action of an impeller on a mass of water. Deep-well turbines, a type of centrifugal pump, fit into the borehole below the water level. A 102 mm standard turbine has a maximum capacity of about 900 liters per minute. Another type if centrifugal pump, the jet pump, has the advantage of being able to function in crooked boreholes. Submersible pumps, also of the centrifugal type, are operated only by electricity. Rotary screw pumps, Archimedes screw pumps are used to raise small quantities of water. (Seigler-IPA)
W80-05995

SWAZILAND DAM,
Municipal Engineer (Johannesburg), Vol 10, No 1, p 33-35, January-February.

Descriptors: *Dam construction, *Dam sites, *Irrigation canals, *Hydraulic structures, concrete-lined canals, Irrigation engineering, Earth dams, Sugarcane, Impounded waters, Flood protection, Diversion, Diversion structures, Foreign countries.

A dam and 44 Km of canal are being constructed at a cost of R18 million by S. Hilton Barber (Swaziland) (Pty) Limited for the Swaziland Government's Ministry of Works, Power and Communications. The dam is part of the R140 million sugar mill project. Construction is on the Black Imbuluzi River and will include the dam, outlet tower, culvert, spillway, 44 Km of canal, a balance reservoir, an inverted syphon, access roads, a construction camp, and remote gauging weirs. Following the construction of employee facilities at the site, work on the foundations of the dam began in February of 1978. By June of 1978 the river had been diverted and excavation and flank preparation was underway. The dam wall is designed to be 40 meters high and will impound 155 million cu m of water. The dam will have 2.2 cu m of fill material. Water from the dam will be diverted by the 53 m high outlet tower to the canal discharge structure, through the 40 Km long canal to the sugar mill. The canal sections are parabolic with linings of reinforced concrete 60 mm thick. About 30,000 cu m of concrete will be used for the canal linings and associated structures. Work at the site is proceeding 24 hours a day, 6 days a week. The dam will provide irrigation water for 10,000 hectares of sugar cane. (Seigler-IPA)
W80-05997

THE BIGGEST HYDRO-ELECTRIC PROJECT IN THE WORLD.
Construction in Southern Africa, Vol 23, No 11, p 63165, February 1979. 2 Fig.

Descriptors: *Hydroelectric plants, *Hydroelectric power, *Engineering structures, Generators, Cofferdams, Water utilization, Diversion, Diversion structures, Excavation, Dam construction, Earth handling equipment, Rockfill dams, Drilling equipment, *Parana River(Brazil-Paraguay), Brazil, Paraguay.

The Itaipu hydro-electric power plant located on the Parana River between Brazil and Paraguay will have 18 generating units, each rated at 700MW, for a total capacity of 12,600,000 kW. The 29 billion cu m reservoir will cover 1,350 sq Km and will be 220 Km long with an average width of 8 Km. Investments to date total $5.08 billion. Structures to be built are part of the project include the following diversion channel, a diversion control structure, main cofferdams, the main dam, right and left wind dams, spillway, powerhouse and reservoir. The total crest length of all the dams will be 7,655 m. The powerhouse at the foot of the main dam will cover the full width of the river. A straight gravity type concrete dam will be used for diversion control. The main dam and powerhouse will be protected by two huge cofferdams and rockfill with a clay core. Three concrete plants on each side of the river will supply 300,000 cu m of cement each month for construction. Approximately 22 million cu m will have to be excavated for the diversion channel and another 20 million cu m for the main dam, spillway, and other structures. Machine used for the excavations include Atlas Copco heavy ROC 701 crawler drills, Atlas Copco medium heavy ROC 601 drills, Atlas Copco ZR5 Pack stationary compressors, and a full fleet of earthmoving vehicles. The workforce at the site totals approximately 19,400 men. (Seigler-IPA)
W80-05998

8H. Rapid Excavation

TEMPORARY COFFERDAM AT KOEBERG,
G. Johnson.
The Civil Engineering Contractor, Vol 13, No 4, p 33-38, January 1979, 6 Fig.

Descriptors: *Cofferdams, *Nuclear powerplants, *Water cooling, *Engineering structures, Intakes, Pumping plants, Excavation, Sheet piling, Boreholes, Dewatering, Bedrock, Rock foundations, Beaches, *South Africa.

The cofferdam and subsequent excavation for the construction of the cooling water inlet structure and pumphouses for the Koeberg Nuclear Power Station, South Africa's first nuclear power station, were completed on October 12, 1978, two months ahead of schedule. Cooling water for the plant will be taken from the Atlantic Ocean by an inlet structure and pumphouses constructed on the beach. A major portion of the pumphouses will be below sea level, requiring an impermeable cofferdam for consturction. The cofferdam consists of a bund with rockfill and sand, a sheet pile wall, and two rows of dewatering boreholes. The bund begins at about 1 m below mean sea level and extends to about 7 m above mean sea level. A 9 m wide access road was built on top of the bund. Sheet piles were driven into rock at 12.5 m below sea level behind the bund to act as an impervious wall to keep water out of the excavation. Two levels of boreholes, a total of 150, were sunk to bedrock to dry out the ground and to remove any water seeping through or under the pile wall. The contractor for the construction of the cofferdam was Underwater Construction A system of standby pumps and generators, flashing lights and sirens, was installed to warn of any failure of the dewatering system during pumphouse construction. A total of 200,000 cu m of material was excavated for the pumphouse construction. (Seigler-IPA)
W80-05996

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

AQUACULTURE: EMERGING ISSUES OF LAW AND POLICY,
For primary bibliographic entry see Field 6E.
W80-05914

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition And Processing

AQUACULTURE: EMERGING ISSUES OF LAW AND POLICY,
For primary bibliographic entry see Field 6E.
W80-05914

10C. Secondary Publication And Distribution

ARCTIC STREAM PROCESSES--AN ANNOTATED BIBLIOGRAPHY,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
K. M. Scott.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.25. Geological Survey Water-Supply Paper 2065, 1979. 78 p.

Descriptors: *Arctic, *Streams, *Bibliographies, *Investigations, *Resources development, Environment, Glaciers, Permafrost, Oil, Gasoline, Information retrieval, Publications, Documentation, Indexing.

This bibliography selectively summarizes investigations to date (1978) dealing with the physical processes of streams in the Arctic. The specialized annotations include aspects of stream processes described in subordinate parts of general papers on the arctic environment and therefore not evident in author-abstract bibliographies. Foreign contributions--Canadian, Scandinavian, and Russian--are summarized, in the case of Russian literature primarily by means of papers in translation journals. Until 1970 the role of streams in development of the arctic landscape was commonly considered subordinate to that of glacial and frost-related processes. This conclusion changed, however, with the findings of the many new studies begun in response to oil and gas discoveries in the late 1960's. The conclusions of these studies, made to provide both the engineering data for resource development and the information to assess the impacts of that development, were in general agreement that stream processes throughout the Arctic were significantly more important than previously had been thought. (Kosco-USGS)
W80-05712

PROCEEDINGS, SYMPOSIUM ON WATER RESOURCES RESEARCH IN KENTUCKY, JUNE 2-3, 1980.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-199565, Price codes: A04 in paper copy, A01 in microfiche. 1980. 63 p. OWRT A-999-KY(4).

Descriptors: *Water resources, *Water quality, *Conferences, *Kentucky, Planning, Land use, *Abstracts, Remote sensing, Regulation, Mine water, Water pollution sources, Geological surveys, Aquatic animals, Aquatic plants, Mathematical models.

Abstracts of 45 papers presented at the symposium are given. Information provided for each paper includes title, location, principal investigator, agency, period of project, objective, and present work and accomplishments. References are provided with some of the abstracts. Topics covered by the papers include: water resources data, water quality -- biology, groundwater, modeling, water quality -- management planning, water quantity, and water quality, -- mine water. An addendum covers Hydropower Studies, Comprehensive Water Resources Planning, Regulatory Functions, and the West Kentucky Land Cover Classification Project: A Study of the Utility of Landsat Multispectral Data Processing in Water Quality Management. (Seigler-IPA)
W80-05751

THE HYDROLOGIC ENGINEERING CENTER PUBLICATIONS.
Hydrologic Engineering Center, Davis, CA.
March 1980. 12 p.

Descriptors: *Publications, *Bibliographies, *Documentation, Information retrieval, *Hydrologic Engineering Center, Administrative reports, Seminar proceedings, Project reports, Research reports, IHD volumes, Computer program documentation, Training documents, Technical papers.

The publications of the Hydrologic Engineering Center were listed with prices and ordering information. Publications include administrative reports, seminar proceedings, project reports, research reports, IHD volumes, computer program documentation, training documents, and technical papers. (Preece-ISWS)
W80-05763

10F. Preparation Of Reviews

CRITERIA FOR THE INSTABILITY OF UPPER-STAGE PLANE BEDS,
Reading Univ. (England). Sedimentology Research Lab.
For primary bibliographic entry see Field 2J.
W80-05936

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*U.S. GOVERNMENT PRINTING OFFICE: 1980-0-311-059/5

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A17	20.00	E17	42.50	T17	1,080.00
A18	21.00	E18	45.50	T18	1,140.00
A19	22.00	E19	50.50	T19	1,200.00
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